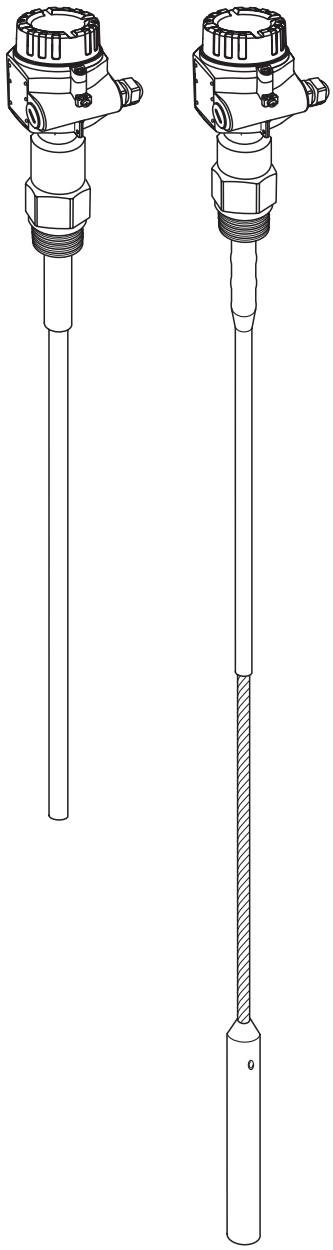
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Solicap M FTI55, FTI56

Capacitive Level Limit Switch



BA300F/00/en/08.06
71033216

Endress+Hauser

People for Process Automation

Brief overview

Note!
These Operating Instructions describe the installation and initial commissioning of the level measuring device. It considers all of the functions that are necessary for a usual measuring task.

For quick and easy commissioning:

Safety instructions	
Explanation of the warning symbols For special instructions, refer to the corresponding location in the respective chapter. The priority is indicated by the Warning ⚠, Caution ☝ and Note symbols ✎.	→ Page 6

▼

Installation	
This section describes the required steps when installing the device and the installation conditions (such as dimensions).	→ Page 14

▼

Wiring	
The device is shipped, for the most part, completely wired and ready to plug in.	→ Page 32

▼

Display and operating elements	
This section provides an overview of the arrangement of the display and operating elements of the device.	→ Page 42

▼

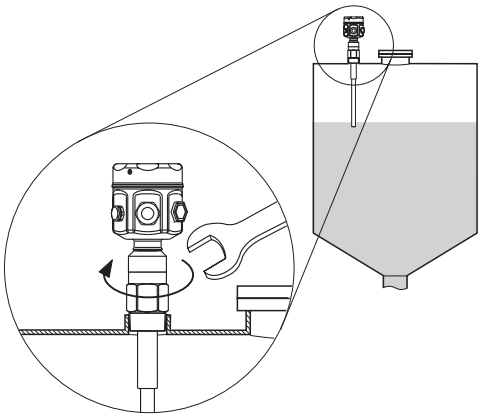
Commissioning	
The "Commissioning" chapter shows you how to switch on the device and check its functions.	→ Page 44

▼

Troubleshooting	
If faults occur during operation, use the checklist to find the reason. This section lists measures you can take yourself to remedy any faults that may occur.	→ Page 61

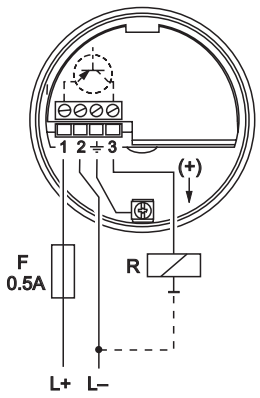
Brief operating instructions

1. Install probe



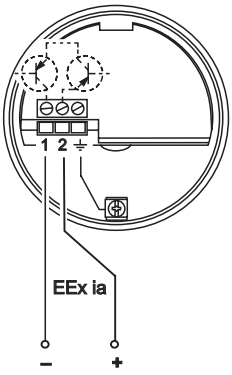
2. Wiring
3. Connect power supply

FEI52



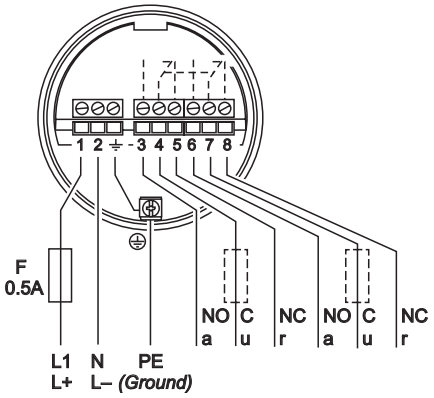
U – 10…55 V *(DC)*

FEI55



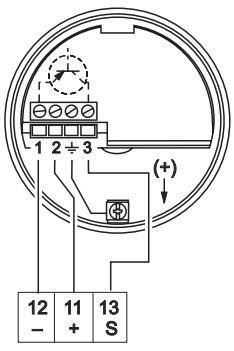
U– 11…36
e.g. PLC

FEI54



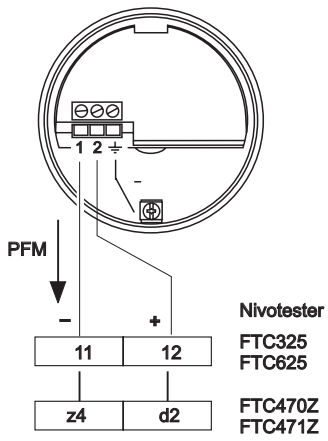
U~ 19…253 V *(AC)* / U– 19…55 V *(DC)*

FEI53



Nivotester
FTC325 3-WIRE

FEI57S



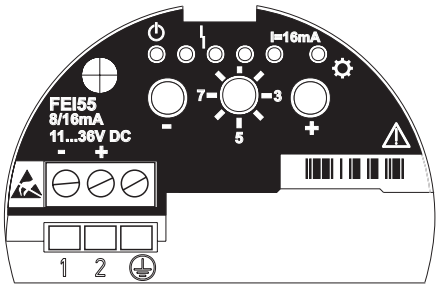
Nivotester
FTC325
FTC625

FTC470Z
FTC471Z

BA300F0en01

4. Configuring the device and switching on the power supply

FEI52, FEI54, FEI55



BA300Fxx003

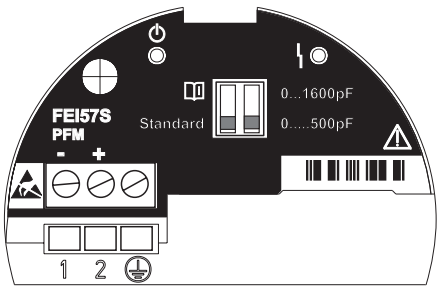
- Green LEDs (⏻ operational status – flashing)
- Red LED (↯ fault message)
- Yellow LED (✲switching status)
- Key (–)
- Key (+)
- Mode switch (position 1-8)
  - 1 : Operation
  - 2: Calibration (empty/full)
  - 3: Switchpoint adjustment
  - 4: Measuring range setting
    Δs mode/build-up mode
  - 5: Switching delay
  - 6 : Self-test
  - 7: Fail-safe mode (MIN/MAX)
  - 8: Configuration/upload, download

✎ Note!
To execute the various functions, press and hold the key for at least 2 seconds.

Mode	Key –	Key +	Symbol	Function/Mode	LED Signals
1				Operation	☼ ● ● ● ● ●
	press together for 20 sec.			Reset to factory settings	☼ ● ● ● ● ● → → → →
2	press			Empty calibration	☼ ● ● ● ● ●
		press		Full calibration	● ● ● ● ☼ ●
3	press for <	press for >	Δc	Switchpoint adjustment	☼ ● ● ● ● ● 2 4 8 16 32 pf
4	press			Measurement range, small/big	☼ ● ● ● ● ● 500 1600 pf
		press 2 x	Δs	Two-point control Build-up mode	build-up ● ● ● ☼ ☼ ● off on
5	press for <	press for >	τ	Switching delay	● ☼ ● ● ● ● 0.3 s 1.5 s 5 s 10 s
6	press together			Device self test (Proof test)	● ● ● ● ☼ ● active
7	press for MIN	press for MAX		Minimum/ maximum failsafe	● ● ● ☼ ● ● MIN MAX
8	press for down-load	press for up-load		Up-Download Sensor EEPROM	☼ ● ● ● ☼ ● down-load up-load

BA300Fen002

FEI53, FEI57S



BA300Fxx004

- Green LED (⏻ operational status)
- Red LED (↯ fault message)
- DIP switch (left),
  - Standard: If the measuring range is exceeded no alarm is output.
  - 🕮: If the measuring range is exceeded an alarm is output.
- DIP switch (right), span
  - Range 1: 0... 500 pF
  - Range 2: 0...1600 pF

Table of contents

1 Safety instructions

1.1 Designated use

The Solicap M FTI55 and FTI56 are compact capacitive level measuring devices for level limit detection in bulk solids.

1.2 Installation, commissioning and operation

The Solicap M's state-of-the-art construction meets operating safety requirements and complies with all applicable standards and EU directives. However, if it is used improperly or if it is not put to its intended use, it can be a source of application-related dangers, such as product overflow due to incorrect installation or configuration. Therefore, the installation, electrical connection, commissioning, operation and maintenance of the measuring device only may be carried out by trained specialist personnel authorized by the facility's owner/operator for this purpose. The specialist personnel must have read and understood these Operating Instructions and must follow the instructions they contain. Modifications or repairs to the device can be carried out only if it is expressly stated in the Operating Instructions that these are permitted.

1.3 Operational safety

1.3.1 Hazardous areas

If the measuring system is used in hazardous areas, the corresponding national/federal standards and regulations must be observed. The device is accompanied by separate Ex documentation, which is an integral part of this documentation. Observe the installation instructions, connection data and safety instructions provided there.

- Ensure that the specialists are adequately trained.
- Observe the metrological and technical safety requirements for the measuring points.

1.4 Safety conventions and symbols

We have defined the following safety instructions to indicate safety-related or alternative procedures. Each instruction is identified by a corresponding pictogram.

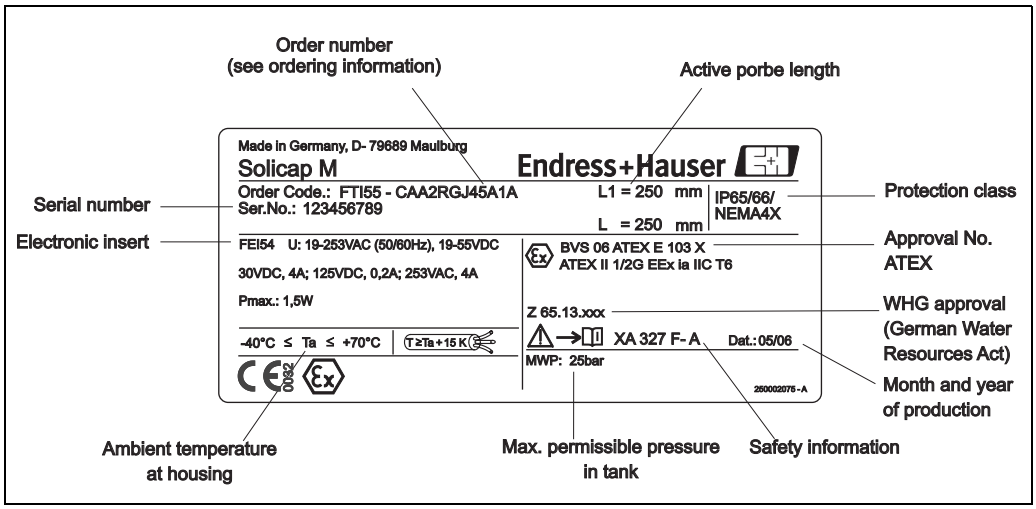
Safety instructions	
	**Warning!** This symbol indicates an action or procedure which, if not performed correctly, can result in serious injury, a safety hazard or the destruction of the device.
	**Caution!** This symbol indicates an action or procedure which, if not performed correctly, can result in injury or destruction of the device.
	**Note!** This symbol indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.
Type of protection	
	**Explosion-protected, prototype-tested apparatus** If this symbol appears on the nameplate of the device, the device can be used in hazardous or non-hazardous areas according to its approval.
	**Hazardous areas** In the drawings in these Operating Instructions, this symbol identifies hazardous areas. Devices located in hazardous areas and lines for these devices must have corresponding explosion protection.
	**Safe areas (non-hazardous areas)** In the drawings in these Operating Instructions, this symbol identifies non-hazardous areas. Devices in the non-hazardous area also must be certified if the connecting lines lead into the hazardous area.
Electrical symbols	
	**Direct current** A terminal at which DC voltage is present or through which DC voltage flows.
	Alternating current A terminal at which AC voltage (sinusoidal) voltage is present or through which AC flows.
	**Ground connection** A grounded terminal which, from the viewpoint of the user, is grounded via a grounding system.
	**Protective ground connection** A terminal that has to be grounded before other connections can be made.
	**Equipotential connection** A connection that has to be connected to the grounding system of the plant. This can be a potential equalization line or a radial grounding system depending on national and company codes of practice.
	**Temperature resistance of the connecting cables** Indicates that the connecting cables must be able to withstand temperatures of at least 85 °C.

2 Identification

2.1 Device designation

2.1.1 Nameplate

Refer to the nameplate of the device for the following technical data:



BA300Fen005

Information on the Solicap M nameplate (example)

2.1.2 Ordering information

Solicap M FTI55

10	Approval:		
	A	Non-hazardous areas	
	B	ATEX II 1/3 D	
	C	ATEX II 1/2 D	
	D	ATEX II 3 D	EEx nA/nL/nC
	F	ATEX II 1 D, II 1/2 GD	EEx ia IIC T6
	K	CSA General Purpose,	CSA C US
	L	CSA/FM IS Cl. I, II, III,	Div. 1+2, Gr. A-G
	M	CSA/FM XP Cl. I, II, III,	Div. 1+2, Gr. A-G
	N	CSA/FM DIP Cl. I, II, III,	Div. 1+2, Gr. E-G
	S	TIIS Ex ia IIC T3	
	T	TIIS Ex d IIC T3	
	Y	Special version, to be specified	

20		Inactive length L3:		
	A	Not selected		
	B	Not selected + 125 mm/5 inch Active build-up compensation		316L
	1	.... mm		316L
	5	.... inch		316L
	9	Special version		

30			Active length L1:	
	A	.... mm,		steel
	B	325 mm,		steel
	C	.... mm,		316L
	D	325 mm,		316L
	H	.... inch,		steel
	K	13 inch,		steel
	M	.... inch,		316L
	N	13 inch,		316L
	Y	Special version, to be specified		

40			Insulation:	
	1		fully insulated PE,	max. 80 °C
	2	75 mm L2,	partially insulated PPS,	max. 180 °C
	3	3 inch L2,	partially insulated PPS,	max. 180 °C
	9	Special version, to be specified		

50		Process connection:			
	AFJ	2",	150 lbs RF	316/316L	
	AGJ	3",	150 lbs RF	316/316L	
	AHJ	4",	150 lbs RF	316/316L	
	BSJ	DN80,	PN10/16 A	316L	EN1092-1 (DIN2527 B)
	BTJ	DN100,	PN10/16 A	316L	EN1092-1 (DIN2527 B)
	B3J	DN50,	PN25/40 A	316L	EN1092-1 (DIN2527 B)
	KFJ	10K 50,	RF	316L	JIS B2220
	KGJ	10K 80,	RF	316L	JIS B2220
	KHJ	10K 100,	RF	316L	JIS B2220
	RGJ	NPT 1½,		316L	thread ANSI
	RG1	NPT 1½,		steel	thread ANSI
	RVJ	R 1½,		316L	thread DIN2999
	RV1	R 1½,		steel	thread DIN2999
	YY9	Special version, to be specified			

60		Electronics; output:	
	W	Prepared for FEI5x	
	Y	Special version, to be specified	
	2	FEI52; 3-wire PNP,	10 to 55 V DC
	3	FEI53; 3-wire,	3 to 12 V signal
	4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC

60						**Electronics; output:**						
						5	FEI55; 8/16 mA,	11 to 36 V DC				
						7	FEI57S; 2–wire PFM					
70							**Housing:**					
						1	F15 316L	IP66, NEMA4X				
						2	F16 polyester	IP66, NEMA4X				
						3	F17 aluminum	IP66, NEMA4X				
						4	F13 Alu + gas-tight probe seal	IP66, NEMA4X				
						5	T13 Alu + gas-tight probe seal + separate connection compartment	IP66, NEMA4X				
						9	Special version, to be specified					
80								**Cable entry:**				
							A	M20 Threaded joint				
							B	Thread G ½				
							C	Thread NPT ½				
							D	Thread NPT ¾				
							G	Thread M20				
							Y	Special version, to be specified				
90									**Probe design:**			
								1	Compact			
								2	2000 mm L4 cable > separate housing			
								3	.... mm L4 cable > separate housing			
								4	80 inch L4 cable > separate housing			
								5	.... inch L4 cable > separate housing			
								9	Special version, to be specified			
100										**Additional equipment:**		
									A	Basic version		
									D	EN10204-3.1 material (316L wetted),	Inspection certificate	
									E	EN10204-3.1 material (316L wetted), NACE MR0175	Inspection certificate	
									Y	Special version, to be specified		
FTI55											Product designation	

Solicap M FTI56

10	Approval:		
	A	Non-hazardous areas	
	B	ATEX II 1/3 D	
	C	ATEX II 1/2 D	
	D	ATEX II 3 D	EEx nA/nL/nC
	F	ATEX II 1 D, II 1/2 GD	EEx ia IIC T6
	K	CSA General Purpose,	CSA C US
	L	CSA/FM IS Cl. I, II, III,	Div. 1+2, Gr. A-G
	M	CSA/FM XP Cl. I, II, III,	Div. 1+2, Gr. A-G
	N	CSA/FM DIP Cl. I, II, III,	Div. 1+2, Gr. E-G
	S	TIIS Ex ia IIC T3	
	T	TIIS Ex d IIC T3	
	Y	Special version, to be specified	

20		Inactive length L3:		
	A	Not selected		
	1	.... mm		316L
	5	.... inch		316L
	9	Special version		

30		Active length L1; anchor weight:		
	A	.... mm, 6 mm rope	316L;	316L
	B	.... mm, 12 mm rope	316L;	316L
	C	.... mm, 8 mm rope	galvanized steel;	steel
	D	.... mm, 14 mm rope	galvanized steel;	steel
	H	.... inch, 0.2" rope	316L;	316L
	K	.... inch, 0.5" rope	316L,	316L
	M	.... inch, 0.3" rope	galvanized steel;	steel
	N	.... inch, 0.6" rope	galvanized steel;	steel
	Y	Special version, to be specified		

40		Insulation:		
	1		fully insulated PA,	max. 120 °C
	2	500 mm L2,	partially insulated PTFE,	max. 180 °C
	9	Special version, to be specified		

50		Process connection:			
	AFJ	2",	150 lbs RF	316/316L	
	AGJ	3",	150 lbs RF	316/316L	
	AHJ	4",	150 lbs RF	316/316L	
	BSJ	DN80,	PN10/16 A	316L	EN1092-1 (DIN2527 B)
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	KGJ	10K 80,	RF	316L	JIS B2220
	KHJ	10K 100,	RF	316L	JIS B2220
	RGJ	NPT 1½		316L	thread ANSI
	RG1	NPT 1½,		steel	thread ANSI
	RVJ	R 1½,		316L	thread DIN2999
	RV1	R 1½,		steel	thread DIN2999
	YY9	Special version, to be specified			

60		Electronics; output:	
	W	Prepared for FEI5x	
	Y	Special version, to be specified	
	2	FEI52; 3-wire PNP,	10 to 55 V DC
	3	FEI53; 3-wire,	3 to 12 V signal
	4	FEI54; relay DPDT,	19 to 253 V AC, 19 to 55 V DC
	5	FEI55; 8/16 mA,	11 to 36 V DC
	7	FEI57S; 2–wire PFM	

70		Housing:	
	1	F15 316L	IP66, NEMA4X

70								**Housing:**					
								2	F16 polyester		IP66, NEMA4X		
								3	F17 aluminum		IP66, NEMA4X		
								4	F13 Alu + gas-tight probe seal		IP66, NEMA4X		
								5	T13 Alu + gas-tight probe seal + separate connection compartment		IP66, NEMA4X		
								9	Special version, to be specified				
80									**Cable entry:**				
									A	M20 threaded joint			
									B	Thread G ½			
									C	Thread NPT ½			
									D	Thread NPT ¾			
									G	Thread M20			
									Y	Special version, to be specified			
90										**Probe design:**			
										1	Compact		
										2	2000 mm L4 cable > separate housing		
										3	.... mm L4 cable > separate housing		
										4	80 inch L4 cable > separate housing		
										5	.... inch L4 cable > separate housing		
										9	Special version, to be specified		
100											**Additional equipment:**		
											A	Basic version	
											D	EN10204-3.1 material (316L wetted),	Inspection certificate
											E	EN10204-3.1 material (316L wetted), NACE MR0175	Inspection certificate
											Y	Special version, to be specified	
FTI56												Product designation	

2.2 Scope of delivery

The scope of delivery consists of:
- The mounted device
- Where applicable, accessories (see Page 60)

Provided documentation:
- Operating Instructions
- Approval documentation, if not included in the Operating Instructions.

2.3 Certificates and approvals

CE mark, Declaration of conformity
The device is designed to meet state-of-the-art operating safety requirements, has been tested, and has left the factory in a condition in which it is safe to operate. The device meets the relevant standards and directives listed in the EC Declaration of Conformity and thus fulfills the legal requirements of the EC Directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

2.4 Registered trademarks

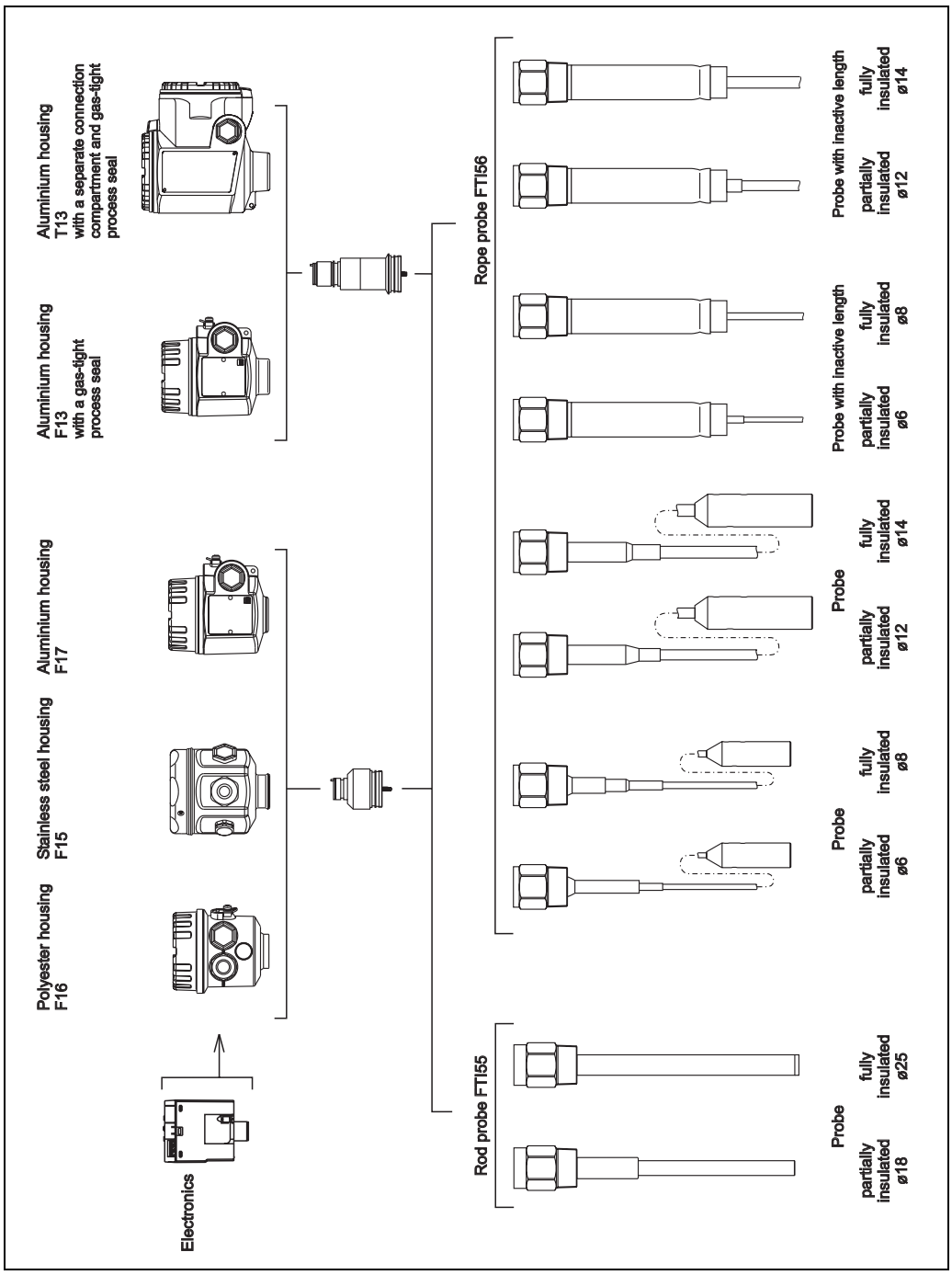
KALREZ®, VITON®, TEFLON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

Tri-Clamp®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

3 Installation

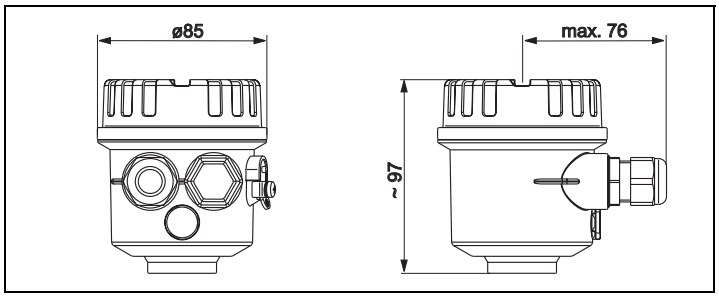
Note!
All dimensions in mm.

3.1 Overview

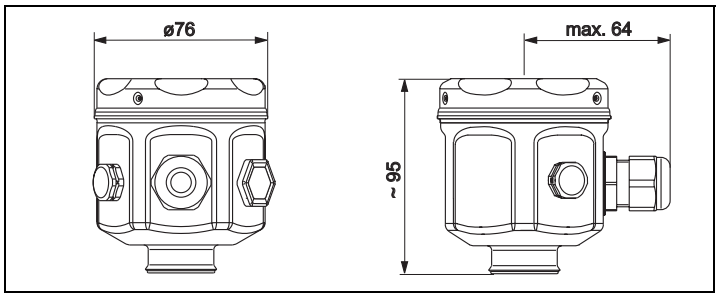


3.2 Housing

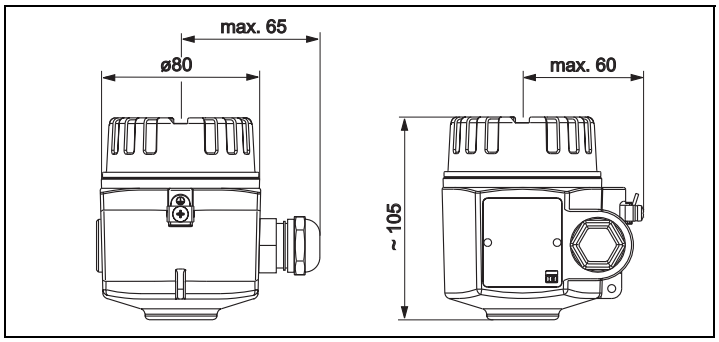
Polyester housing F16



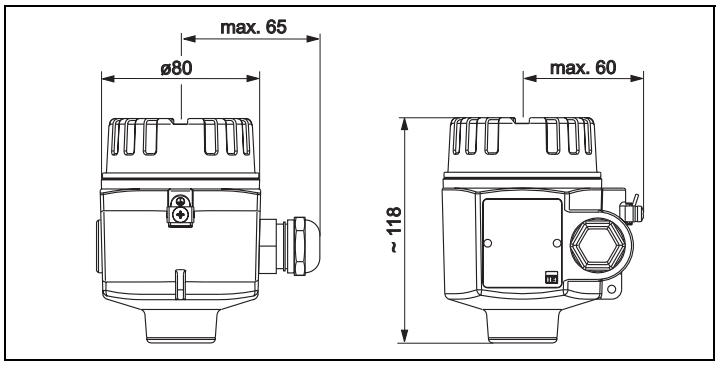
Stainless steel housing F15



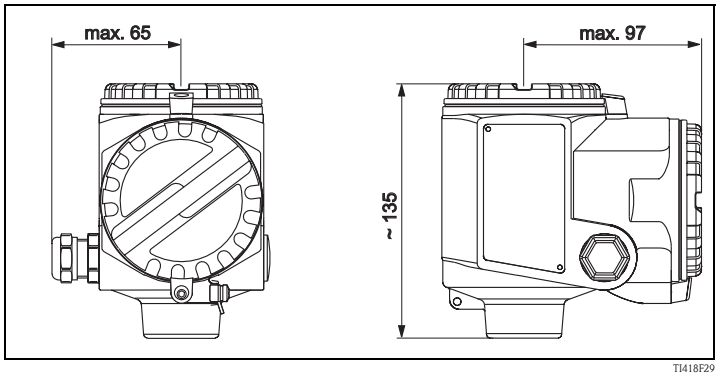
Aluminum housing F17



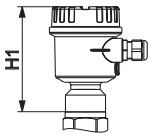
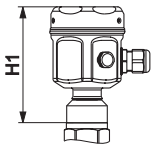
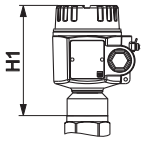
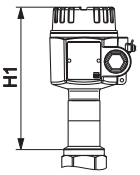
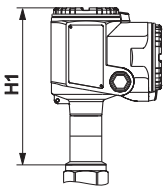
Aluminium housing F13
with gas-tight process seal



Aluminum housing T13
with separate connection compartment and gas-tight process seal

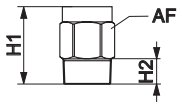
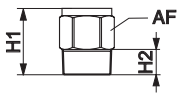
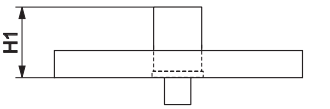


3.3 Housing heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminium housing F13*	Aluminum housing with separate connection compartment T13*
	 TI418F30	 TI418F31	 TI418F32	 TI418F33	 TI418F34
Order code	2	1	3	4	5
FTI55, FTI56					
H1	125	121	131	177	194

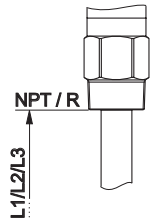
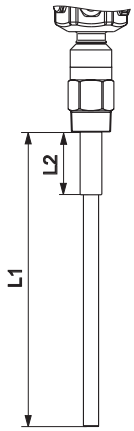
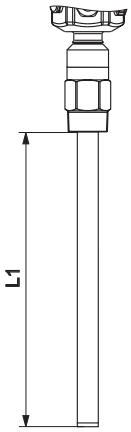
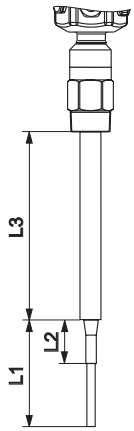
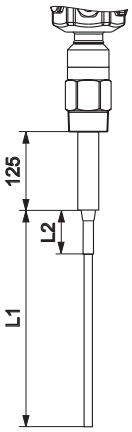
* Housing with gas-tight process seal

3.4 Process connections and flanges

			Under development
	Rod probe	**Rope probe**	**Flanges**
	 TI418Fen35	 TI418Fen36	 TI418F37
	(DIN ISO228/I)	(ANSI B 1.20.1)	(EN1092-1) (ANSI B 16.5) (JIS B2220)
Thread	R/NPT	R/NPT	
For pressures up to	25 bars	25 bars	(depends on flange)
Version / order code	R 1½ / RVJ R 1½ / RV1 NPT 1½/ RGJ NPT 1½ / RG1	R 1½ / RVJ R 1½ / RV1 NPT 1½/ RGJ NPT 1½ / RG1	
Dimensions	H1 = 77 H2 = 25 AF = 50	H1 = 66 H2 = 25 AF = 50	

3.5 Rod probes FTI55

Note!
Total length of the probe from the start of the thread: L = L1 + L3
(+ 125 mm with active build-up compensation)

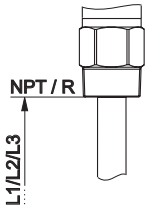
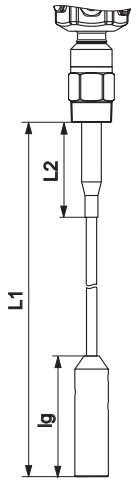
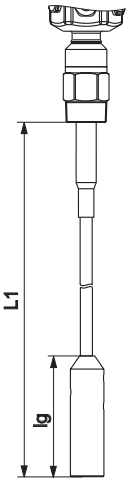
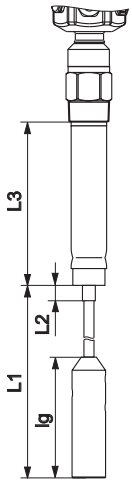
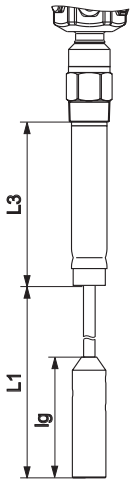
			Under development	
	Rod probe partially insulated	**Rod probe fully insulated**	**Rod probe with inactive length partially/fully insulated**	**Rod probe with active build-up compensation partially/fully insulated**
 TI418F38				 TI418F39
Total length (L)	100 to 4000	100 to 4000	300 to 6000	100 to 4000
Active rod length (L1)	100 to 4000	100 to 4000	100 to 4000	100 to 4000
Inactive rod length (L3)	-	-	200 to 2000	-
Length of partial insulation (L2)	75	-	- / 75	- / 75
Probe rod diameter + insulation thickness (mm)	18 3.5	18 3.5	18 3.5	18 3.5
ø Active build-up compensation Length (mm)	– / –	– / –	– / –	36 125
Lateral loading capacity (Nm) at 20 °C	300	300	300	200
Maximum process temperature (°C)	180	80	80/180	80/180
For use in mounting nozzles	-	-	X	-
In the event of condensate on tank ceiling	-	-	X	-

X = recommended

Length tolerance up to 1 m: 0 to –5 mm 1 m to 3 m: 0 to –10 mm 3 m to 6 m: 0 to –20 mm

3.6 Rope probes FTI56

Note!
Total length of probe from start of thread: L = L1 + L3

	Rod probe partially insulated		Rod probe fully insulated		Rope probe with inactive length partially insulated		Rope probe with inactive length fully insulated	
 TI418F59							 TI418F40	
Total length (L)	500 to 22000		500 to 22000		500 to 24000		500 to 24000	
Active rope length (L1)	500 to 22000		500 to 22000		500 to 22000		500 to 22000	
Length of partial insulation (L2)*	500		–		500		500	
Inactive length (L3)	–		–		200 to 2000		200 to 2000	
Probe rope diameter + insulation thickness (mm)	6 1	12 2	6 1	12 1	6 1	12 2	6 1	12 1
ø Tensioning weight (mm)	30	40	30	40	30	40	30	40
Length of tensioning weight (lg)	150	250	150	250	150	250	150	250
Tensile loading capacity (kN) of probe rope at 20 °C	30	60	30	60	30	60	30	60
Maximum process temperature (°C)	180		120		180		120	
For use in mounting nozzles	–		–		X		X	
In the event of condensate on tank ceiling	–		–		X		X	

X = recommended
* The length of the partial insulation extends, at maximum, to the tensioning weight.

Length tolerance up to 1 m: 0 to –10 mm | 1 m to 3 m: 0 to –20 mm | 3 m to 6 m: 0 to –30 mm | 6 m to 24 m: 0 to –40 mm

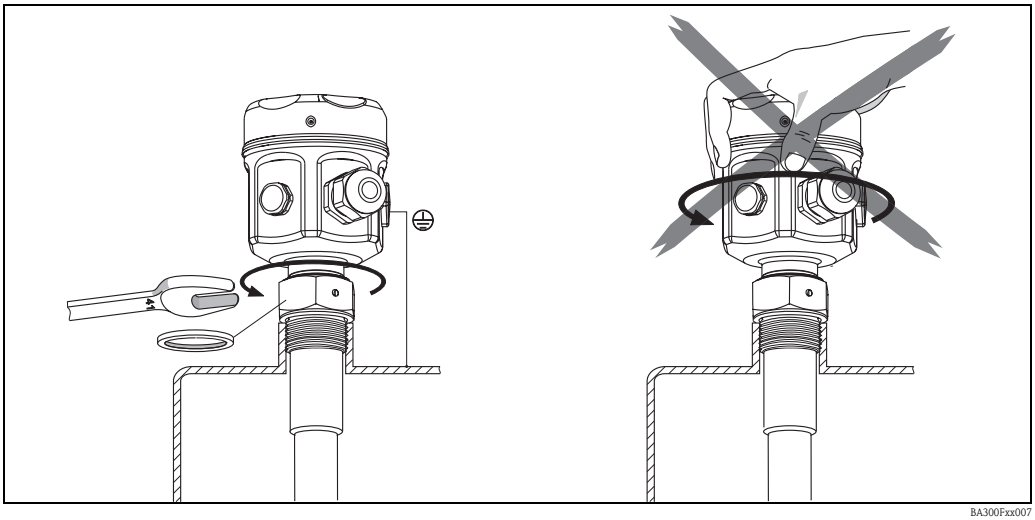
3.7 Installation instructions

3.7.1 Installation

Probe with thread

- R 1½ and 1½ NPT (conical):
  Wrap thread in suitable seal material. Ensure that the electrical connection between the probe and the tank is correct.
- If the process connection of the probe is insulated from the metal tank (e.g. using seal material), the ground connection on the probe housing must be connected to the tank using a short line.

Caution!
- Do not damage the probe insulation during installation.
- Do not turn the housing while screwing in the probe, as otherwise the housing fixture can be damaged.



BA300Fxx007

Installation tools

The following tools are required for installation:
- Tool for mounting flanges
- or a size 50 Allen key for the threaded connection
- and a Phillips-head screwdriver for aligning the cable entry.

Installation instructions

The Solicap M FTI55 (rod probe) can be installed from above and from the side.
The Solicap M FTI56 (rope probe) can be installed vertically from above.

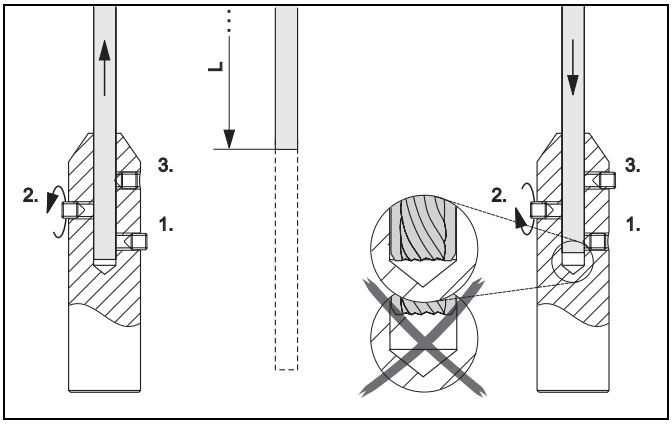
Note!
The probe may not come into contact with the container wall! Do not install probes in the area of the filling curtain!

Shortening the probe

Rod probe:
The partially insulated version can be shortened at a later stage by the user.

Rope probe:
Both versions (partially and fully insulated) may be shortened at a later stage (see next page).

- Loosen the set screws in the weight and pull out the rope.
- Shorten the probe rope to the desired length.
- Slide the rope back in, as far as the end of the bore, and secure it using the set screws.



BA300Fxx018

General notes

Filling the silo

The filling stream should not be directed onto the probe.

Angle of material flow

Note the expected angle of the material flow or of the outlet funnel when determining the mounting location or probe length.

Distance between probes

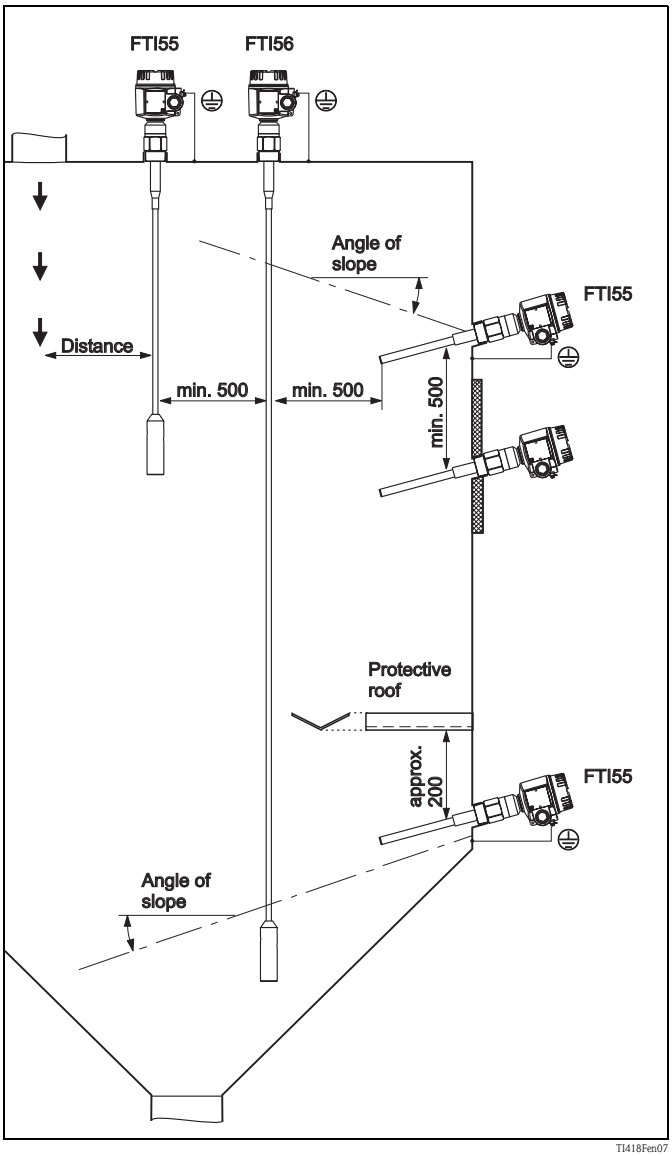
When installing several probes in a silo, a minimum distance of 0.5 m between the probes must be observed.

Threaded coupling for mounting

When installing the Solicap M FTI55, FTI56, the threaded coupling should be as short as possible.
Condensation or product residue may occur in a long threaded coupling and interfere with the correct operation of the probe.

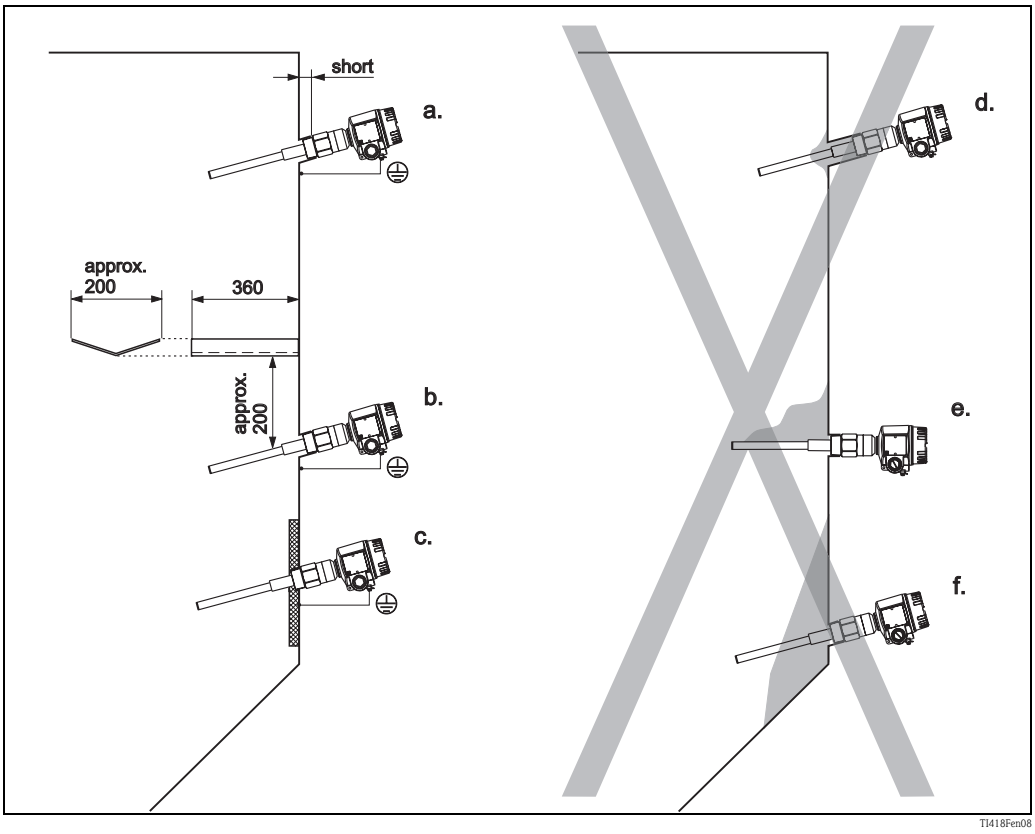
Heat insulation

In the event of high temperatures in the silo:
Insulate the external silo wall to avoid exceeding the permitted temperature of the Solicap M housing.
Heat insulation also prevents condensation from forming near the threaded boss in the silo. This reduces build-up and the risk of error switching.



TI418Fen07

3.7.2 Preparing to install rod probes FTI55



** Protective roof*
In a silo with metal walls

Correct installation

a. For maximum level limit detection, a short threaded coupling is used.

b. For minimum detection, a protective roof protects against collapsing mounds or high strain on the probe rod caused by the removal of material, if using the Solicap M FTI55.

c. In the event of light build-up on the silo wall, the threaded coupling is welded internally. The probe tip points slightly downwards so that bulk solids slide off more easily.

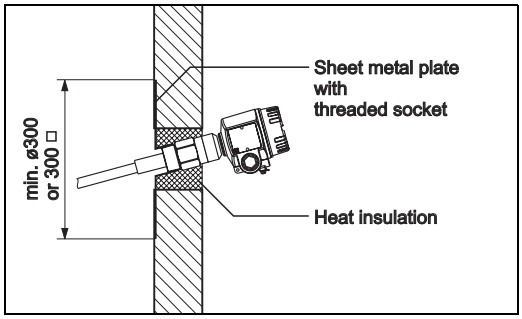
Incorrect installation

d. The threaded coupling is too long. This may cause material to settle inside and result in error switching.

e. Horizontal mounting means a risk of error switching in the event of heavy build-up on the silo wall. In this case, the Solicap M FTI55 (rod probe) with inactive length is recommended.

f. In areas where product build-up occurs, the device cannot detect if the silo is "empty". In this case, the FTI56 (rope probe) should be installed from above.

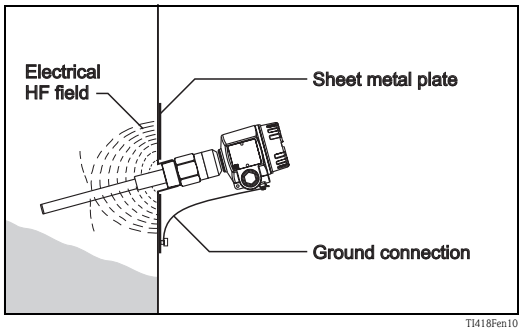
In this example, the steel plate forms the counter electrode.
Heat insulation prevents condensation and therefore build-up on the steel plate.



In a silo with concrete walls

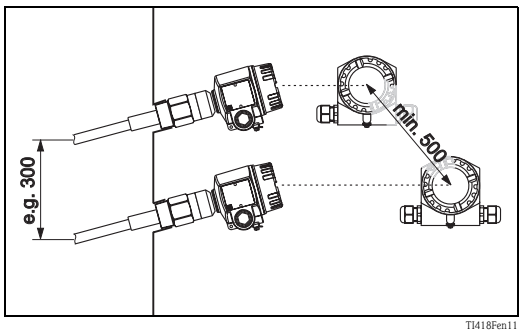
When installing in a silo made of plastic, a sheet metal plate must be attached to the exterior of the silo as a counter electrode.
This plate can be either square or round.

– Dimensions in the case of a thin silo wall with a low dielectric constant:
  approx. 0.5 m along each side or ø0.5 m;
– Dimensions in the case of a thicker silo wall or wall with a higher dielectric constant:
  approx. 0.7 m along each side or ø0.7 m.



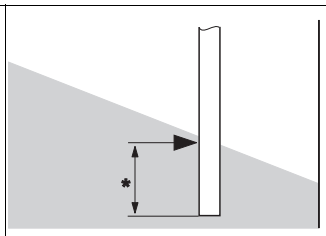
In a silo with plastic walls

The required minimum distances can be observed by installing in a staggered manner.



For small differences in level

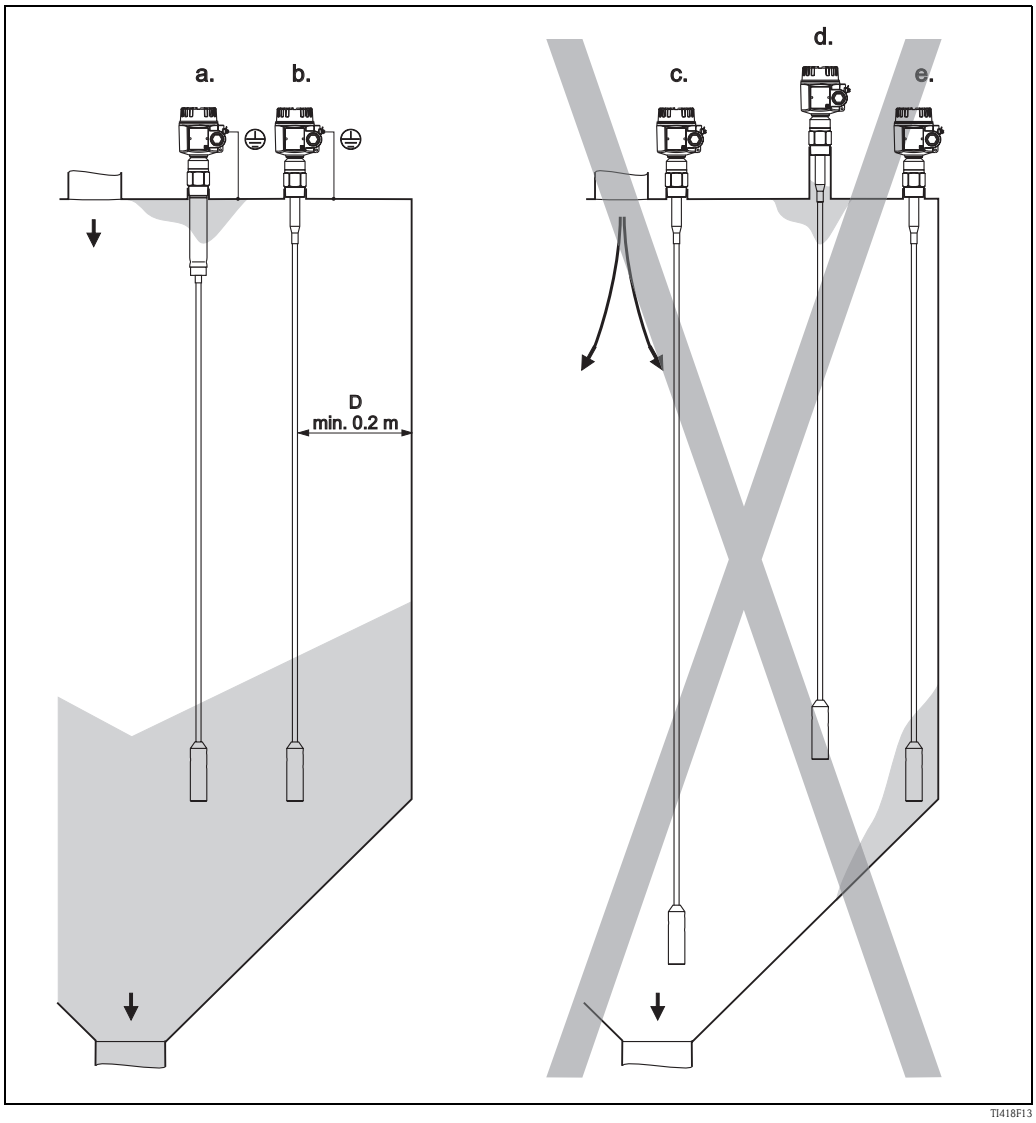
Probe length

Product properties, relative dielectric constant ε_r	 TI418F12 ** additional length to be covered*
Electrically conductive	25 mm
Nonconductive	
$\varepsilon_r > 10$	100 mm
$\varepsilon_r > 5$ to 10	200 mm
$\varepsilon_r > 2$ to 5	500 mm

Note!

- The lengths given are minimum lengths in addition to the distance between the sealing surface of the flange or thread and the level limit required. For probe length tolerances see Page 17 ff.
- To ensure problem-free operation, it is important that the difference in capacitance between the covered and uncovered parts of the probe is at least 5 pF.
- If you do not know the dielectric constant of the material, contact us for advice.

3.7.3 Preparing to install rope probes FTI56



In a silo with metal walls
Distance D between the probe and the wall approx. 10 to 25 % of the silo diameter

Correct installation

a. Solicap M FTI55, FTI56 with inactive length in the event of condensation and material build-up on the silo roof.

b. At the correct distance from the silo wall, the material inlet and the material outlet.
Close to the wall, for reliable switching in the case of a low dielectric constant (not for pneumatic filling!).
For pneumatic filling, the distance from the probe to the wall should not be too short, as the probe may swing.

Incorrect installation

c. If too close to the material inlet, inflowing bulk solids may damage the sensor.
If close to the centre of the material outflow, high tensile forces at this point may cause the probe to break off or subject the silo roof to excessive strain.

d. The threaded coupling is too long. This may cause condensation and dust to settle inside which may result in error switching.

e. If too close to the silo wall, the probe may swing slightly against the wall or come in contact with build-up. This can result in error switching.

Silo roof

Ensure that the silo roof is of a sufficiently stable construction!
High tensile forces may occur when material is being extracted, particularly in the case of heavy and powdery bulk solids which have a tendency to form build-up.

The rope tension calculation program from Endress+Hauser can be used to calculate the expected rope tension values.

Coarse-grained bulk solids

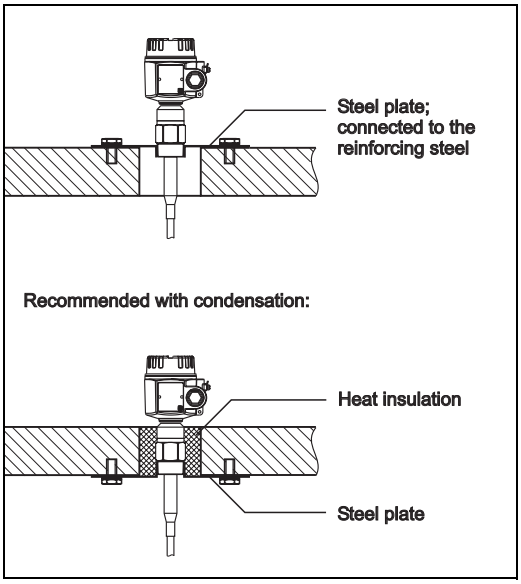
In silos with extremely coarse-grained or extremely abrasive bulk solids, the use of a Solicap M FTI55 or FTI56 is recommended only for maximum detection.

Distance between probes

To avoid mutual interference, probes must be positioned at least 0.5 m apart. This applies also when using several Solicap M devices in adjacent silos with nonconductive walls.

The threaded coupling, with a maximum length of 25 mm, should if possible protrude into the silo so as to reduce the effects of condensation and build-up.

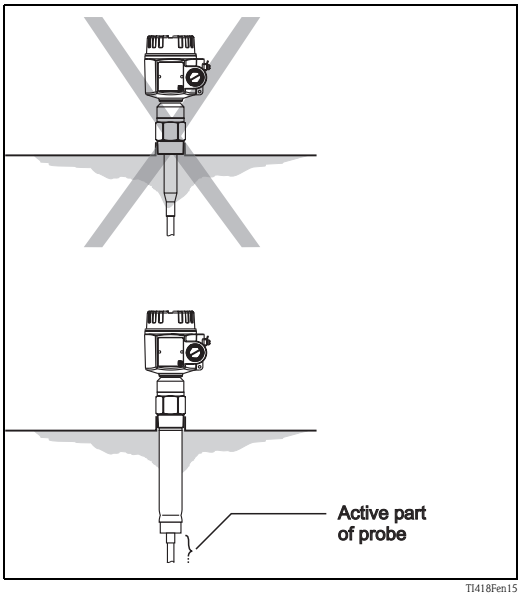
Heat insulation reduces condensation and therefore build-up on the steel plate.



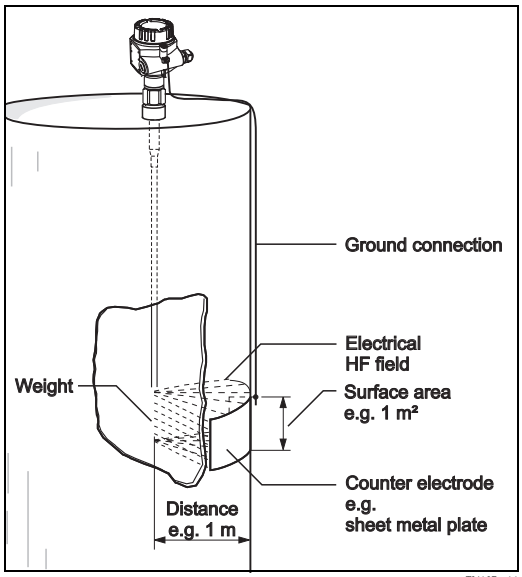
In a silo with concrete walls

Recommended:
Use the FTI56 with inactive length.

The inactive length prevents moisture and build-up forming between the active part of the probe and the silo roof.

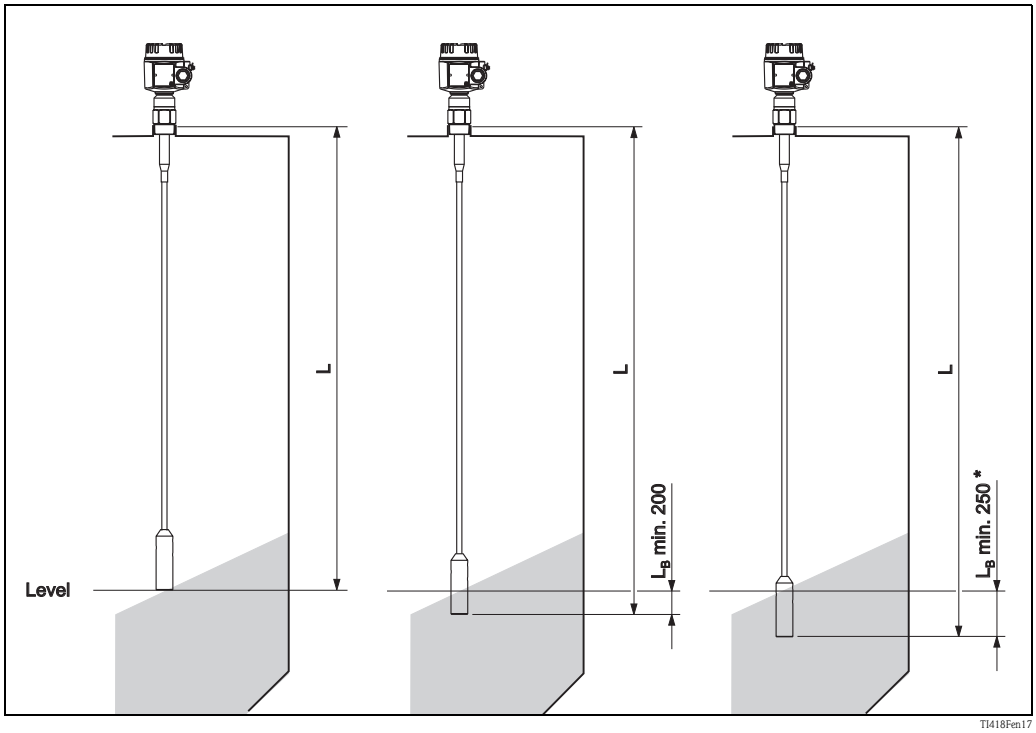


When installing in a silo made of plastic, a counter electrode must be mounted on the silo exterior at the same height as the tensioning weight.
The length of the edge of the counter electrode should be approximately the same length as the distance between the tensioning weight and the silo wall.



In a silo with plastic walls

Range of sensor lengths



Electrically conductive bulk solids (e.g. coal)	Bulk solids with high dielectric constant (e.g. flour)	Bulk solids with low dielectric constant (e.g. dried grain)

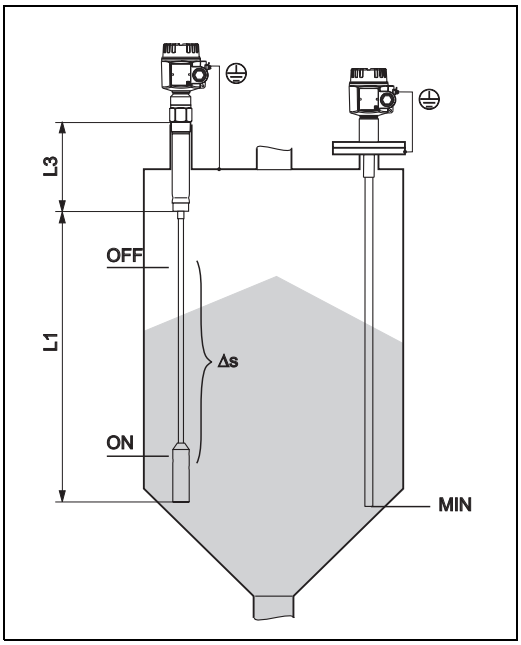
* L_B (covered length):
For nonconductive bulk solids with a low dielectric constant, the rope probe must be approx. 5 % (but no less than 250 mm) longer than the distance between the tank roof and the required level limit.

3.7.4 Measuring conditions

Note!
- When installing in a nozzle, use inactive length (L3).
- To control a screw conveyor (Δs mode), rod probes and rope probes can be used. The on-value and off-value are determined by the empty and full calibration;
  – suitable only for nonconductive bulk solids.

DK > 10	Measuring range up to 4 m
5 < DK < 10	Measuring range up to 12 m
2 < DK < 5	Measuring range up to 20 m

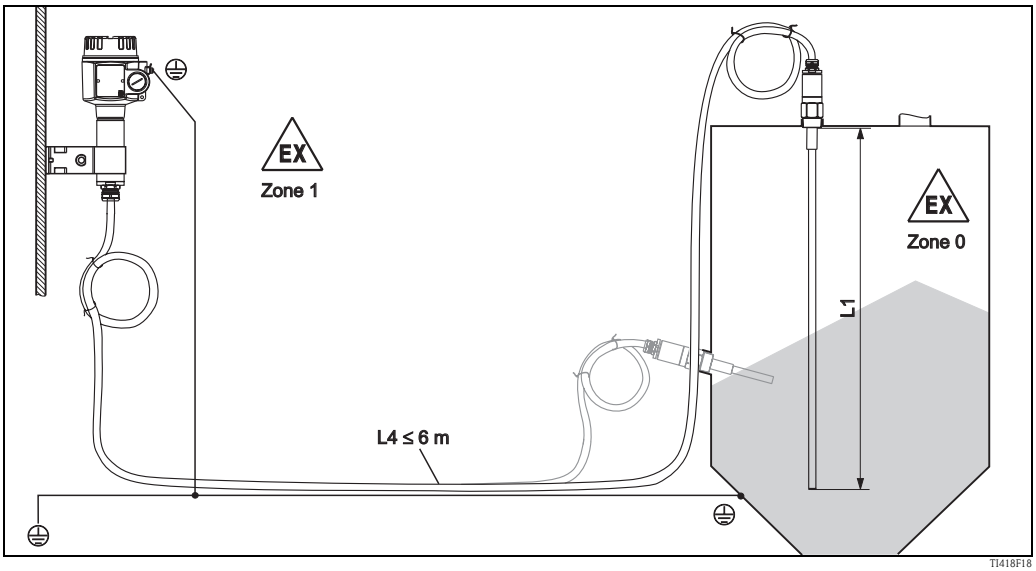
- The minimum capacitance change for level limit detection must be ≥ 5 pF.



TI418F41

3.8 With separate housing

For information on how to order, see also "Ordering information" from Page 9 under "Probe design".



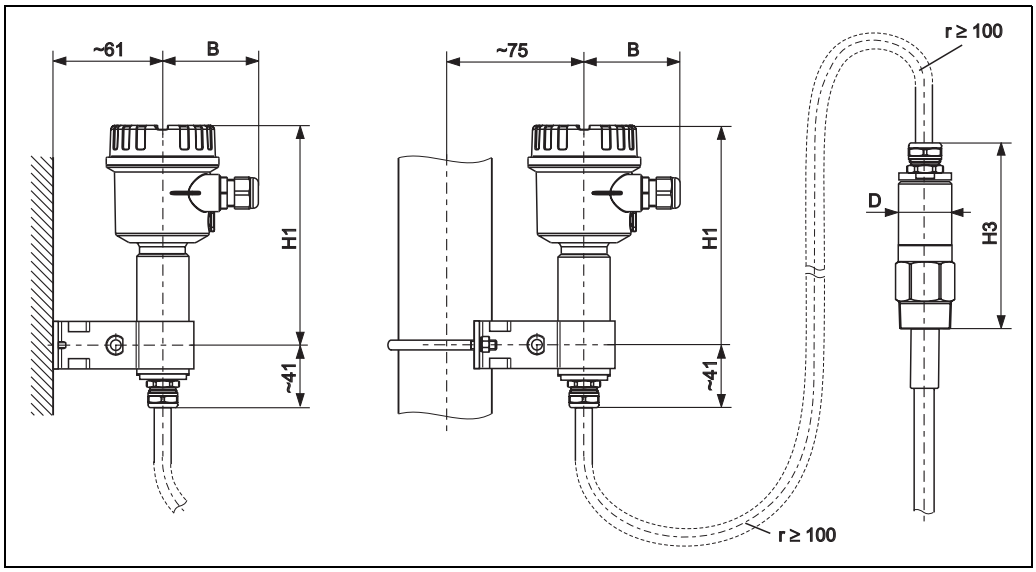
TI418F18

Rod length L1 max. 4 m;
Rope length L1 max. 22 m

Note!
- The maximum connection length between the probe and the separate housing is 6 m (L4). When ordering a Solicap M with a separate housing, the desired length must be specified.
- If the connecting cable is to be shortened or passed through a wall, it must be separated from the process connection. See also Page 29.
- The cable has a bending radius of r ≥ 100 mm. This must be observed as a minimum!

3.8.1 Extension heights

Housing side: wall mounting Housing side: pipe mounting Sensor side



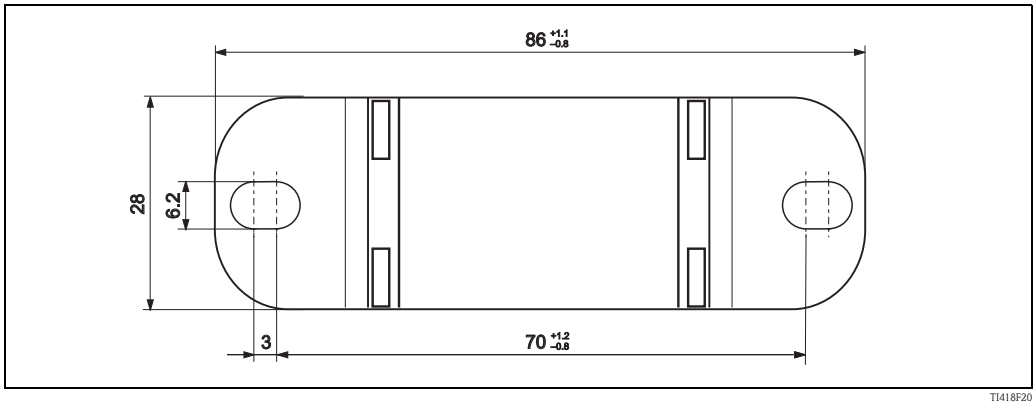
	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17
B	76	64	65
H1	172	166	177

Rod probes, rope probes with tube diameter D

	D	H3
R 1½, NPT 1½	50	130

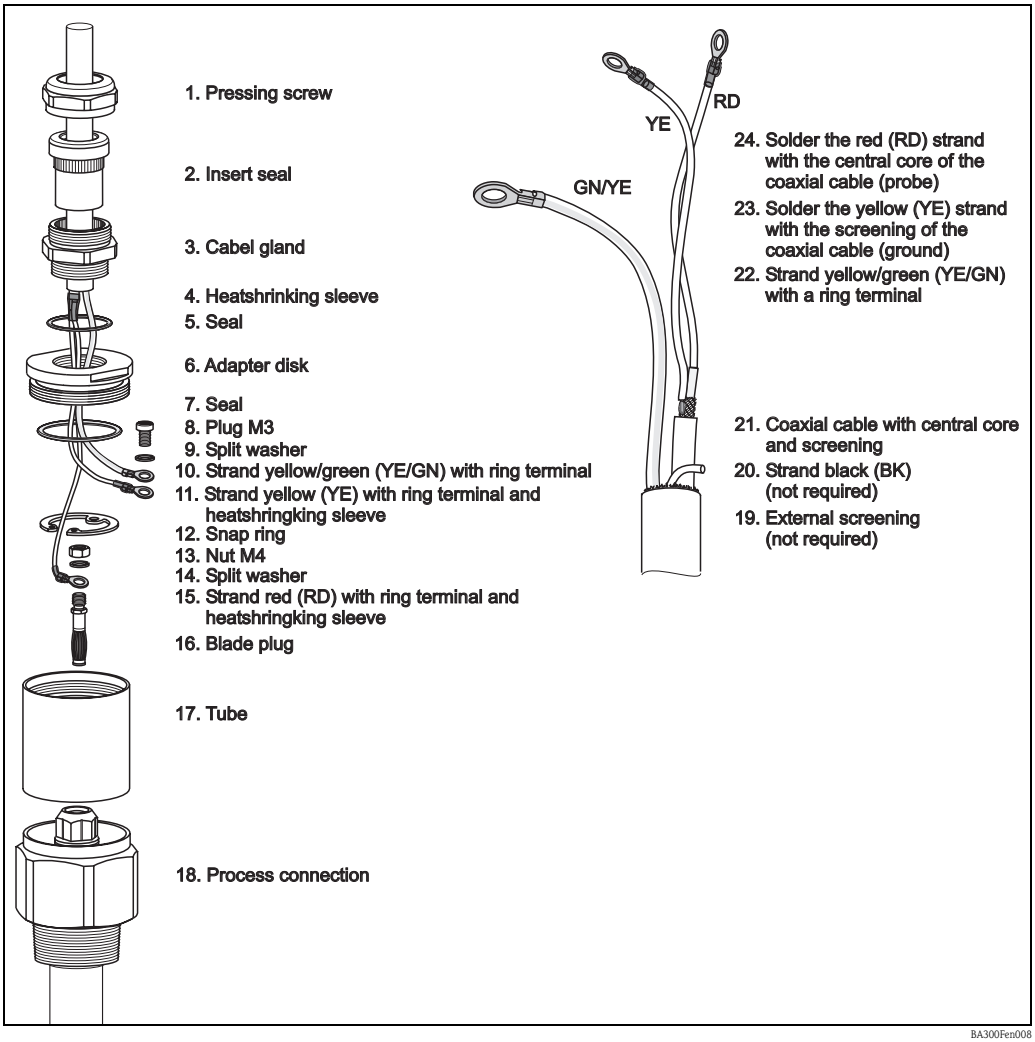
Note!
- Connecting cable: ø10.5 mm
- Outer jacket: silicone, notch-resistant

3.8.2 Wall holder unit



Note that the wall holder unit first has to be screwed to the separate housing before you can use it as a drilling template. The distance between the holes is reduced by screwing it to the separate housing.

3.9 Probe without active build-up compensation



BA300Fen008

3.9.1 Shortening the connecting cable

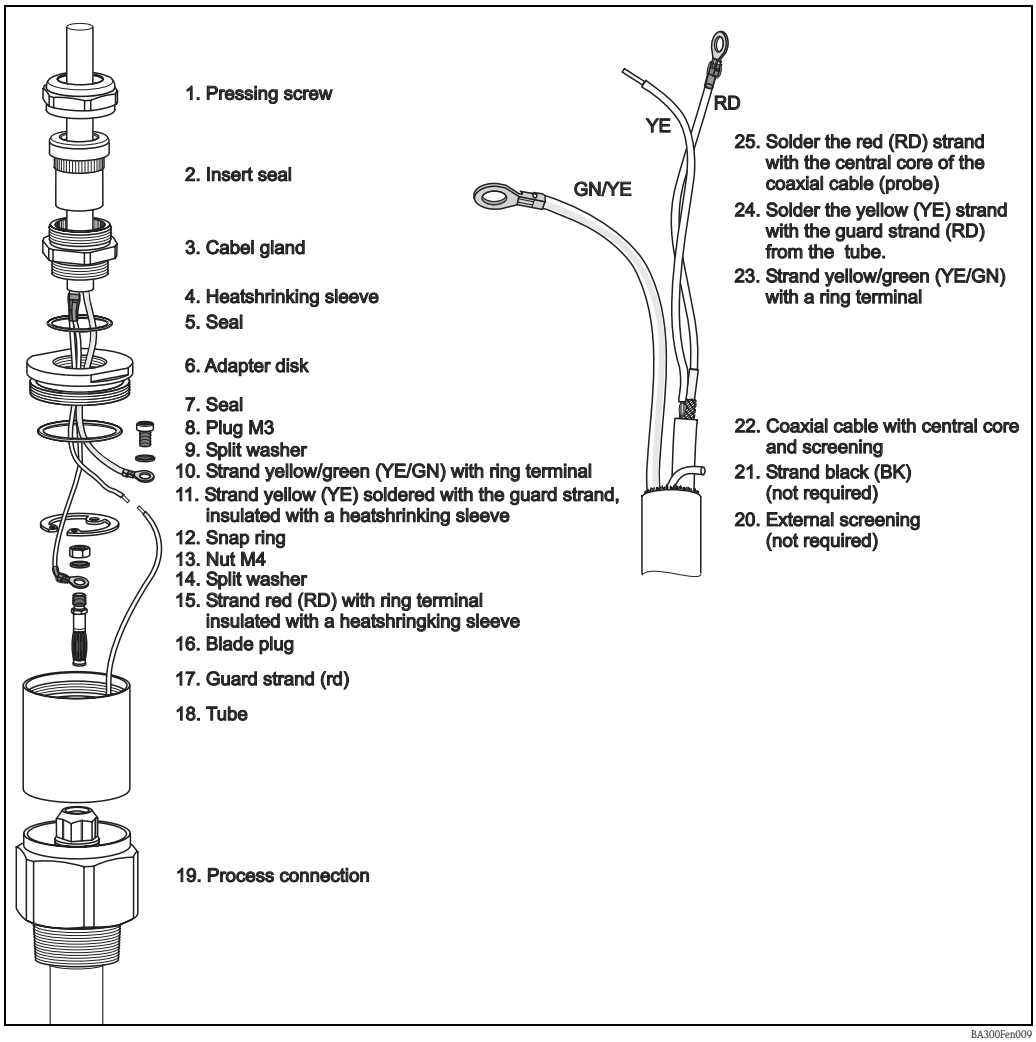
Note!
The maximum connection length between the probe and the separate housing is 6 m.
When ordering a Solicap M with a separate housing, the desired length must be specified.

If the connecting cable is to be shortened or guided through a wall, it must be disconnected from the process connection. To do so, proceed as follows:

- Unscrew the pressure screw (1) using a 22 mm open-end wrench. If necessary, hold the process connection. In doing so, ensure that neither the connecting cable nor the probe is turned in the process.
- Pull the insert seal (2) out of the cable gland (3).
- Using a 22 mm open-end wrench, disconnect the cable gland (3) from the adapter disc. If necessary, hold it against the adapter disc (6) using a 34 mm open-end wrench.
- Disconnect the adapter disc (6) from the sleeve (17).
- Remove the snap ring using a snap ring pliers.
- Using pliers, grab the nut (M6) on the Multilam plug and pull out the plug.

Note!
- If you shorten the cable, we recommend reusing all wires with eyelets.
- If the wires are not reused, the crimp connections of the newly attached eyelets must be insulated, for example using a heat-shrinking sleeve (danger of short circuit).
- All soldered joints must be insulated.

3.10 Probe with active build-up compensation (under development)



BA300Fen009

3.10.1 Shortening the connecting cable

Note!
The maximum connection length between the probe and the separate housing is 6 m.
When ordering a Solicap M with a separate housing, the desired length must be specified.

If the connecting cable is to be shortened or guided through a wall, it must be disconnected from the process connection. To do so, proceed as follows:

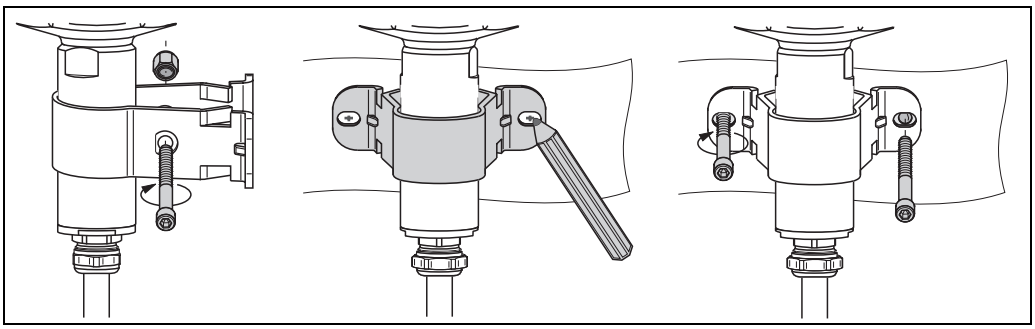
- Unscrew the pressure screw (1) using a 22 mm open-end wrench. If necessary, hold the process connection. In doing so, ensure that neither the connecting cable nor the probe is turned in the process.
- Pull the insert seal (2) out of the cable gland (3).
- Using a 22 mm open-end wrench, disconnect the cable gland (3) from the adapter disc. If necessary, hold it against the adapter disc (6) using a 34 mm open-end wrench.
- Disconnect the adapter disc (6) from the sleeve (17).
- Remove the snap ring using a snap ring pliers.
- Using pliers, grab the nut (M6) on the Multilam plug and pull out the plug.
- Disconnect the yellow wire from the red (guard) wire.
- Then, shorten the connecting cable to the desired length. If the separate housing is in a different room than the probe, you can now route the connecting cable through the wall.
- You can now reassemble the device by following the reverse order of steps.

Note!
- If you shorten the connecting cable, we recommend reusing all wires with eyelets.
- If the wires are not reused, the crimp connections of the newly attached eyelets must be insulated, for example using a heat-shrinking sleeve (danger of short circuit).
- All soldered joints must be insulated.

3.11 Installing bracket for wall and pipe mounting

3.11.1 Wall mounting

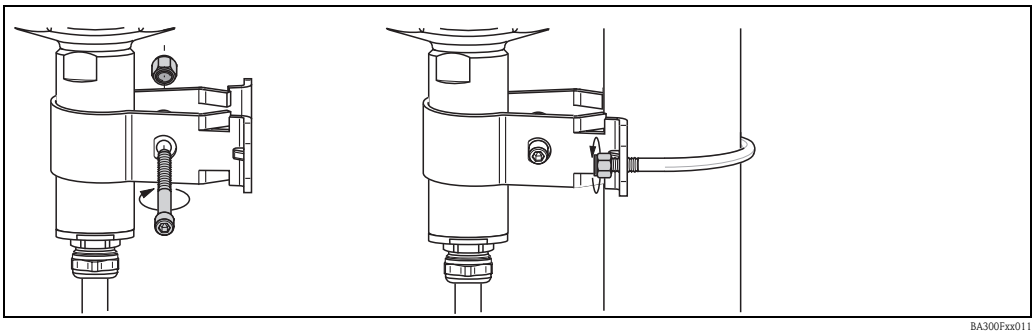
- Push the bracket onto the sleeve and screw it into place.
- Mark the distance between the holes on the wall, and then drill the holes.
- Screw the separate housing to the wall.



BA300Fxx010

3.11.2 Pipe mounting

- Push the bracket onto the sleeve and screw it into place.
- Screw the separate housing to the pipe (max. 2").



BA300Fxx011

3.12 Post-installation check

After installing the measuring device, carry out the following checks:
- Is the device damaged (visual inspection)?
- Does the device correspond to the measuring point specifications, including process temperature and pressure, ambient temperature, measuring range, etc.?
- Is the process connection tightened with the correct torque?
- Are the measuring point number and labeling correct (visual inspection)?
- Is the measuring device adequately protected from precipitation and direct sunlight?

4 Wiring

Caution!
Before connecting the supply voltage, note the following:
- The supply voltage must match the information specified on the nameplate (see Page 8).
- Switch off the supply voltage before connecting the device.
- Connect the potential equalization line to the ground terminal on the sensor.

Note!
- When using the probe in hazardous areas, the relevant national standards and the information in the safety instructions (XA) must be observed.
- Use the specified cable gland only.

4.1 Connection recommendation

4.1.1 Potential equalization

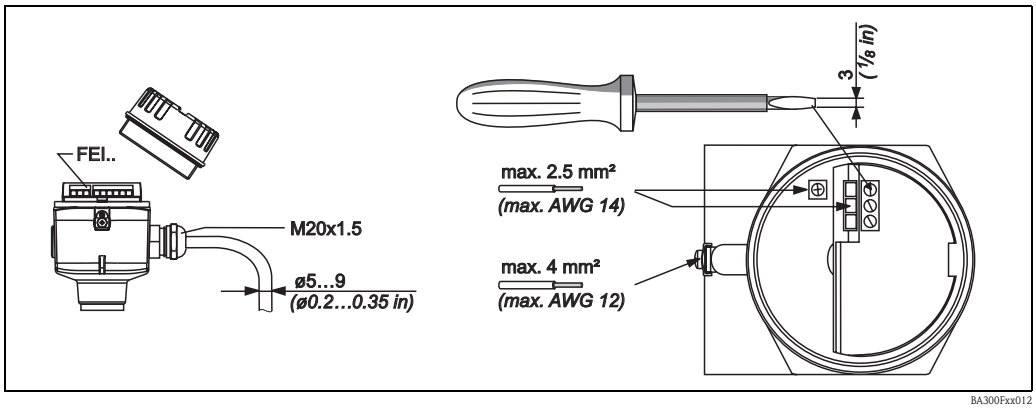
Connect the potential equalization line to the outer ground terminal of the housing (T13, F13, F16, F17). In the case of the stainless steel housing F15, the ground terminal (depending on the version) can also be located in the housing.
For additional safety instructions, refer to the separate documentation for applications in hazardous areas.

4.1.2 Electromagnetic compatibility (EMC)

- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity in accordance with EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC).

4.1.3 Cable specification

The electronic inserts can be connected using the usual commercial instrument cables.
If shielded instrument cable is used, apply the shield to both sides.

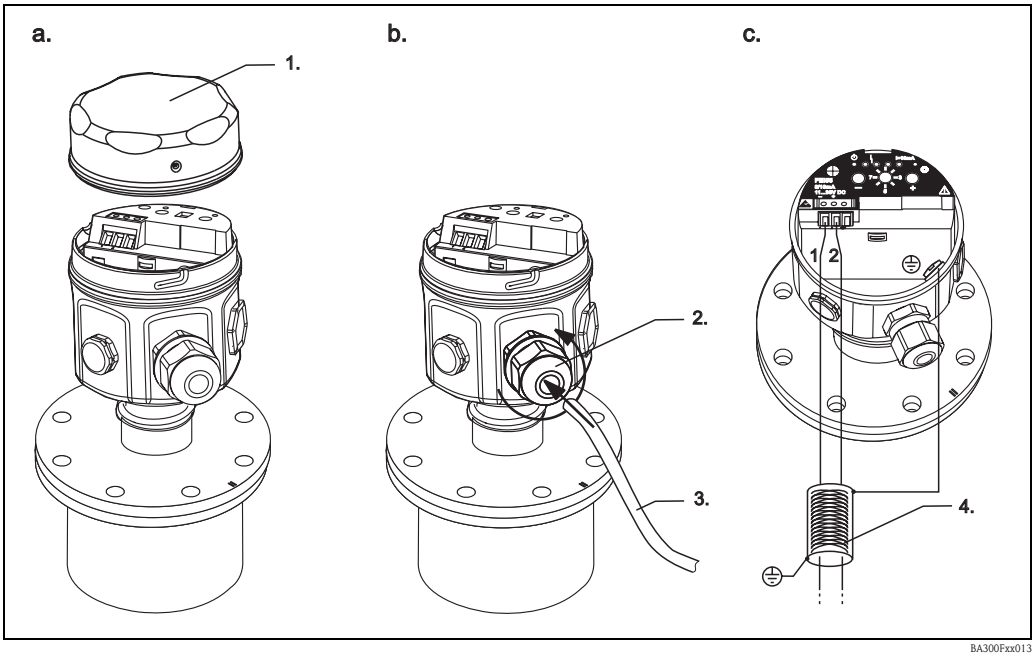


BA300Fxx012

4.2 Wiring in housing F16, F15, F17, F13

To connect the electronic insert to the power supply, proceed as follows:

a. Unscrew the housing cover (1).
b. Remove the cable gland (2) and insert the cable (3).
c. Ground the shield (4) on both sides!



BA300Fxx013

Note!
All further steps depend on the specific electronic insert used, and are described on the following pages:
FEI52 → Page 36
FEI53 → Page 37
FEI54 → Page 38
FEI55 → Page 39
FEI57S → Page 40

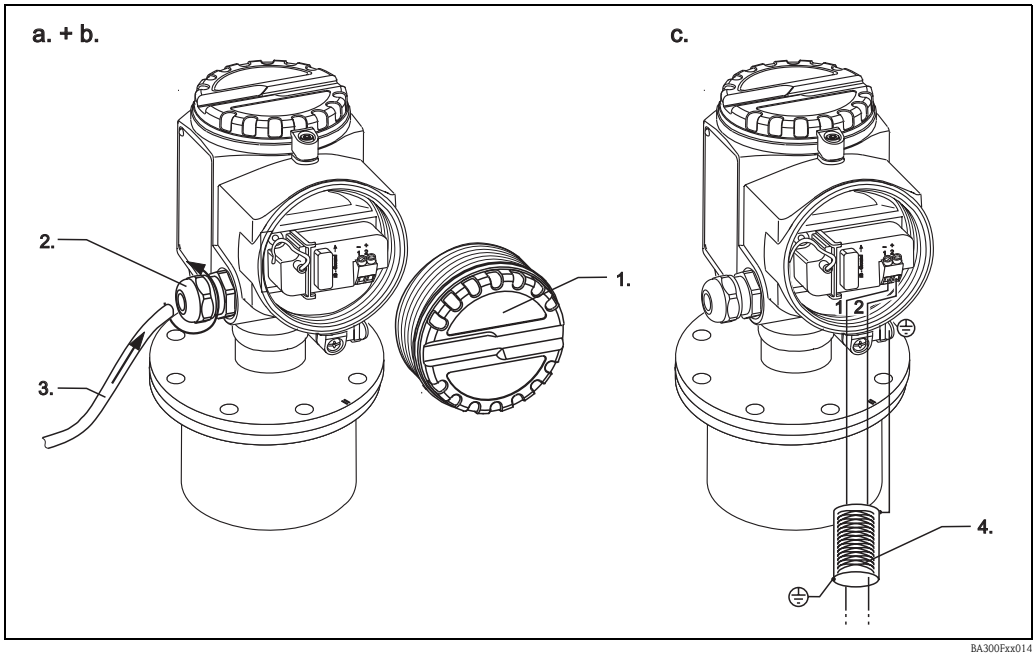
4.3 Wiring in housing T13

To connect the electronic insert to the power supply, proceed as follows:

a. Unscrew the housing cover (1).

b. Remove the cable gland (2) and insert the cable (3).

c. Ground the shield (4) on both sides!



BA300Fxx014

Note!
The connection shown under "c." depends on the type of Ex approval requested.
For connection in a separate connection compartment, the same connection descriptions apply as for the electronic inserts.

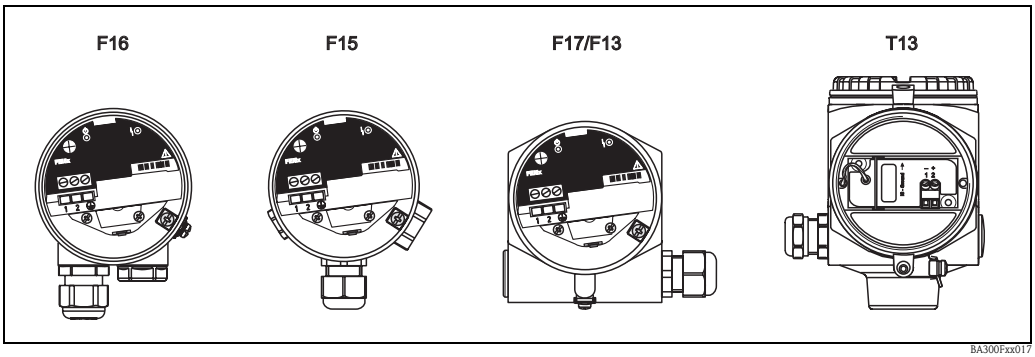
Note!
All further steps depend on the specific electronic insert used, and are described on the following pages:
FEI52 → Page 36
FEI53 → Page 37
FEI54 → Page 38
FEI55 → Page 39
FEI57S → Page 40

4.4 Connecting the device

Connection compartment

Five types of housing are available:

	Standard	EEx ia	Dust ignition-proof	Gas-tight process seal
Plastic housing F16	X	–	–	–
Stainless steel housing F15	X	X	X	–
Aluminum housing F17	X	X	X	–
Aluminum housing F13	X	X	X	X
Aluminum housing T13 (with separate connection compartment)	X	X	X	X



Note!
The nameplate contains important device data.

Cable entry

Cable gland: M20x1.5.
A second cable gland is included with each device.

Cable entry: G ½ or NPT ½, NPT ¾

4.5 Degree of protection

See Page 66, "Degree of protection".

4.6 Connecting the electronic insert FEI52 (DC PNP)

The three-wire DC connection should, wherever possible, be connected as follows:
- To programmable logic controllers (PLCs),
- to DI modules in accordance with EN 61131-2

A positive signal is present at the switch output of the electronic system (PNP).

Power supply

Supply voltage: 10 to 55 V DC
Ripple max. 1.7 V; 0 to 400 Hz
Current consumption: < 20 mA
Power consumption without load: max. 0.9 W
Power consumption with full load (350 mA): 1.6 W
Reverse polarity protection: yes
Separation voltage: 3.7 kV
FEI52 overvoltage protection: overvoltage category III

Signal on alarm

Output signal on power failure or in the event of device failure: I_R < 100 µA

Connectable load

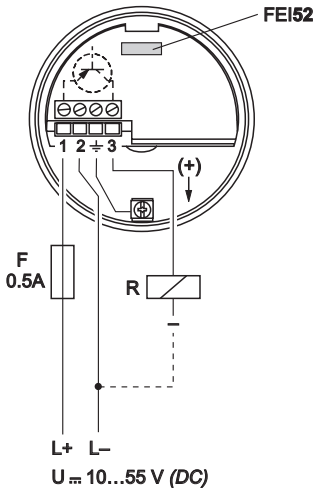
- Load switched via transistor and separate PNP connection, max. 55 V
- Load current max. 350 mA (cyclical overload and short-circuit protection)
- Residual current < 100 µA (with transistor blocked)
- Capacitive load max. 0.5 µF at 55 V; max. 1.0 µF at 24 V
- Residual voltage < 3 V (for transistor switched through)

Connect the FEI52 (DC PNP) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch to position 1 (operation).

✎ Note!
Do not switch on the supply voltage until you have familiarized yourself with the device functions as described on Page 42 "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.



TI418F42

* R = External load ($I_{max.}$ 350 mA, U_{max} 55 V DC)

4.7 Connecting the electronic insert FEI53 (3-WIRE)

The 3-wire DC connection is used in conjunction with the Nivotester switching device FTC325 3-WIRE from Endress+Hauser; the switching device's communication signal operates at 3 to 12 V.

The changeover of fail-safe mode (MIN) / (MAX) and the level limit calibration take place on the Nivotester.

Power supply

Supply voltage: 14.5 V DC
Current consumption: < 15 mA
Power consumption: max. 230 mW
Reverse polarity protection: yes
Separation voltage: 0.5 kV

Signal on alarm

Voltage at terminal 3: < 2.7 V

Connectable load

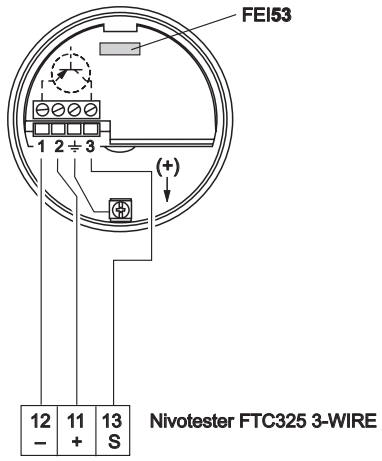
- Floating relay contacts in the connected switching unit Nivotester FTC325 3-WIRE
- For the contact load capacity, refer to the technical data of the switching device.

Connect the FEI53 (3-WIRE) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.

✎ Note!
Do not switch on the supply voltage until you have familiarized yourself with the device functions as described on Page 42 "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

3. Switch on the supply voltage.



TI418F43

4.8 Connecting the electronic insert FEI54 (AC/DC with relay output)

The universal voltage connection with relay output (DPDT) operates in two different voltage ranges (AC and DC).

Note!
When connecting devices with high inductivity, use a spark suppression system to protect the relay contacts.

Power supply

Supply voltage: 19 to 253 V AC, 50/60 Hz or 19 to 55 V DC
Power consumption: max. 1.6 W
Reverse polarity protection: yes
Separation voltage: 3.7 kV
FEI54 overvoltage protection: overvoltage category III

Signal on alarm

Output signal on power failure or in the event of device failure: relay de-energized

Connectable load

- Loads switched via 2 floating changeover contacts (DPDT)
- I~ max. 6 A; U~ max. 253 V; P~ max. 1500 VA at cos φ = 1;
  P~ max. 750 VA at cos φ > 0.7
- I– max. 6 A to 30 V; I– max. 0.2 A to 125 V
- When connecting a functional extra-low voltage circuit with dual insulation in accordance with IEC 1010, the following applies: The sum of the voltages of the relay output and power supply must not exceed 300 V.

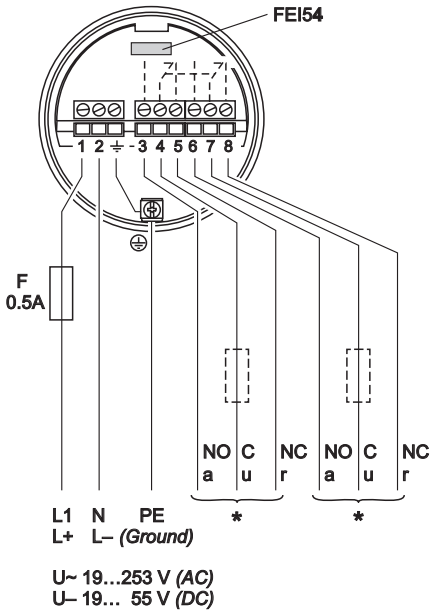
Connect the FEI54 (AC/DC relay) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch to position 1 (operation).

Note!
Do not switch on the supply voltage until you have familiarized yourself with the device functions as described on Page 42 "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.

* Refer also to Connectable load



TI418F47

4.9 Connecting the electronic insert FEI55 (8/16 mA)

The two-wire DC connection should, if possible, be connected as follows:
- To programmable logic controllers (PLCs),
- to AI modules 4 to 20 mA in accordance with EN 61131-2

The level limit signal is sent via an output signal jump from 8 mA to 16 mA.

Power supply

Supply voltage: 11 to 36 V DC
Power consumption: < 600 mW
Reverse polarity protection: yes
Separation voltage: 0.5 kV

Signal on alarm

Output signal on power failure or in the event of device failure: < 3.6 mA

Connectable load

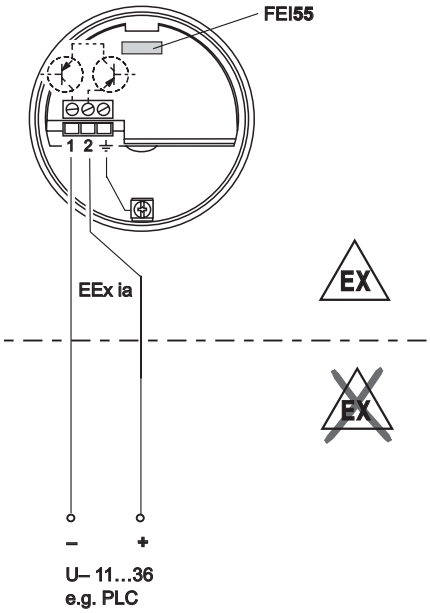
- U = connection DC voltage 11 to 36 V
- I_{max} = 16 mA

Connect the FEI55 (8/16 mA) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.
3. Set the function switch to position 1 (operation).

Note!
Do not switch on the supply voltage until you have familiarized yourself with the device functions as described on Page 42 "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

4. Switch on the supply voltage.



TI418Fen50

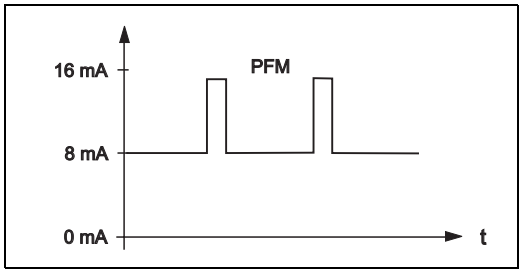
4.10 Connecting the electronic insert FEI57S (PFM)

The two-wire DC connection is used in conjunction with one of the following Nivotester switching devices from Endress+Hauser:
- FTC325 PFM,
- FTC625 PFM (from SW V1.4),
- FTC470Z,
- FTC471Z

The PFM signal is between 17 and 185 Hz.
The changeover of fail-safe mode (MIN) / (MAX) and the level limit calibration take place on the Nivotester.

Power supply

Supply voltage: 9.5 to 12.5 V DC
Power consumption: < 150 mW
Reverse polarity protection: yes
Separation voltage: 0.5 kV



Frequency: 17 to 185 Hz

Output signal

PFM 17 to 185 Hz (Endress+Hauser)

Connectable load

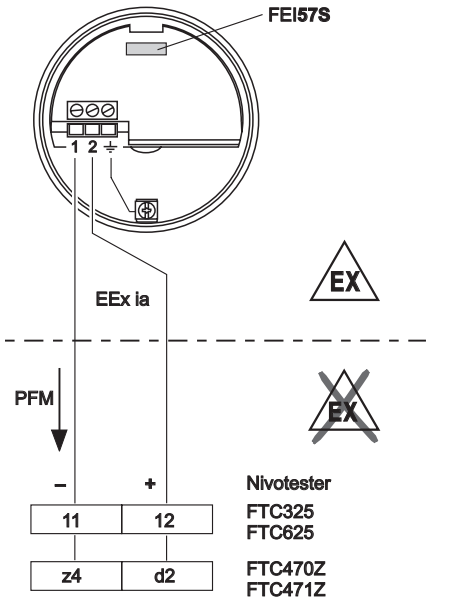
- Floating relay contacts in the connected switching device, Nivotester FTC325 PFM, FTC625 PFM (from SW V1.4), FTC470Z, FTC471Z
- For the contact load capacity, refer to the technical data of the switching device

Connect the FEI57 (PFM) as follows:

1. Make the connection as shown in the graphic.
2. Turn the cable gland until tight.

✎ Note!
Do not switch on the supply voltage until you have familiarized yourself with the device functions as described on Page 42 "Operation". This will ensure that you do not accidentally trigger any processes by switching on the supply voltage.

3. Switch on the supply voltage.



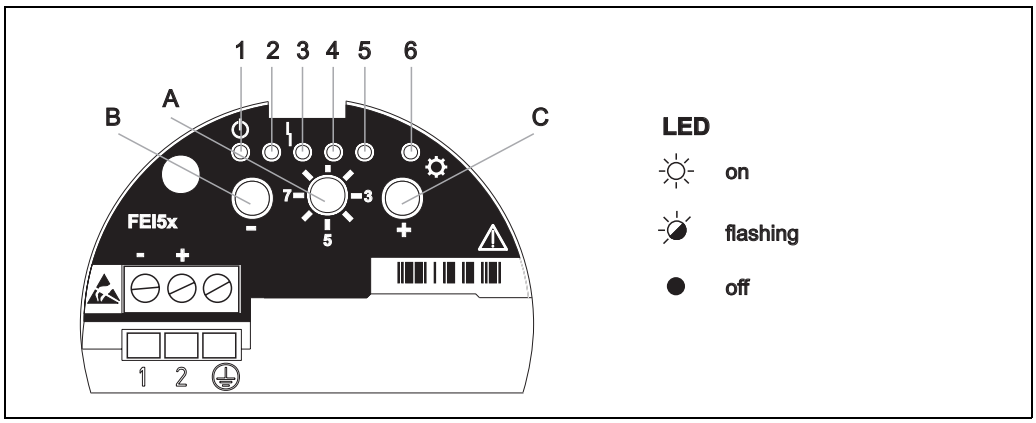
4.11 Post-connection check

After wiring the measuring device, carry out the following checks:
- Is the terminal assignment correct?
- Is the cable gland tightly sealed?
- Is the housing cover screwed on all the way?
- If a power supply is present: If the device is operational, the green LED flashes at 5-second intervals.

5 Operation

5.1 Human interface and display elements for FEI52, FEI54, FEI55

You can operate the electronic inserts FEI52, FEI54 and FEI55 using a functional switch A, the B (–) key and the C (+) key.
The function switch A has eight possible positions. Each position has at least one function.
The operating status of the device is indicated by light emitting diodes (LEDs 1 to 6) on the electronic insert and depends on the position of the function switch.



Note!
To select a function, press the function keys (– and/or +) for at least 2 seconds.

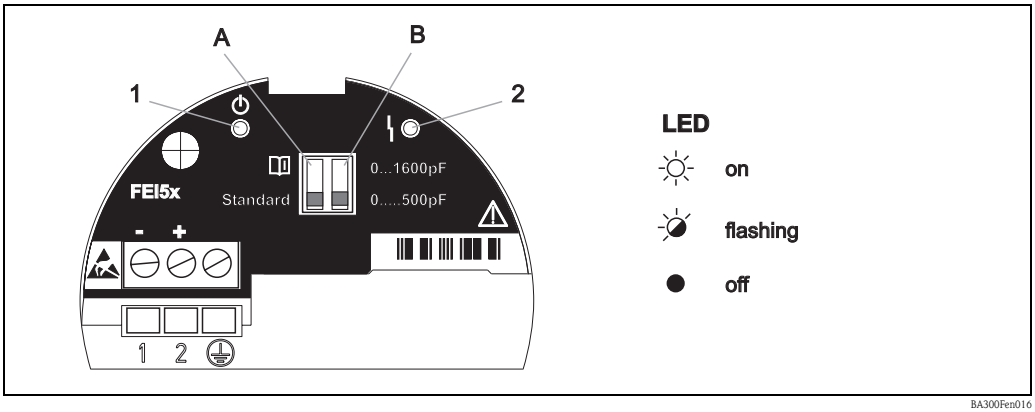
Function switch position	Function	– key	+ key	Light emitting diodes (LED signals)					
A		B	C	1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
1	Operation			**Flashes** Operational LED		**Flashes** (warning/ alarm)			**On/off/ flashes****
	Restore factory setting	Press both keys for approx. 20 s		**On**	–>	–>	–>	–>	**On/off/ flashes****
2	Empty calibration	Press		**On** (present)					**On/off/ flashes****
	Full calibration		Press					**On** (present)	**On/off/ flashes****
3	Switchpoint adjustment	Press for <	Press for >	**On *** (2 pF)	**Off** (4 pF)	**Off** (8 pF)	**Off** (16 pF)	**Off** (32 pF)	**On/off/ flashes****
4	Measuring range	Press for <		**On*** (500 pF)	**Off** (1600 pF)				**On/off/ flashes****
	Two-point control Δs/ build-up mode		Press once Press twice				**Off** Build-up mode	**Off** Δs	**On/off/ flashes****
5	Switching delay	Press for <	Press for >	**Off** (0.3 s)	**On *** (1.5 s)	**Off** (5 s)	**Off** (10 s)		**On/off/ flashes****
6	Self-test (function test)	Press both keys		**Off *** (inactive)				**Flashes** (active)	**On/off/ flashes****
7	MIN/MAX fail-safe mode	Press for MIN	Press for MAX	**Off** (MIN)				**On *** (MAX)	**On/off/ flashes****
8	Upload/download Sensor DAT (EEPROM)	Press for download	Press for upload	**Flashes** (download)				**Flashes** (upload)	**On/off/ flashes****

* These settings are factory settings.
** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

5.2 Human interface and display elements for FEI53, FEI57S

The electronic inserts FEI53 and FEI57S are used in conjunction with Nivotester switching devices. The functions of the DIP switches (A and B) and the LEDs (1 and 2) are described in the table below.

The operating status of the device is indicated by LEDs (LED 1 and 2) on the electronic insert and provides information on operational readiness (1) and, where applicable, the type of fault (2).



Note!
A description of the human interface and display elements of the Nivotester switching device is provided in the documentation that accompanies the device.

DIP switches	Function	Light emitting diodes (LED signals)	
		1 (green) ⏻ Operational	2 (red) ↯ Fault
A	Standard[1]: If the measuring range is exceeded **no** alarm is output.	**Flashes*** **	**Flashes */on ****
	🕮: If the measuring range is exceeded **one** alarm is output.	**Flashes*** **	**Flashes */on ****
B	Span: The measuring range is between 0 and 500 pF.	**Flashes*** **	**Flashes */on ****
	Span: The measuring range is between 0 and 1600 pF.	**Flashes*** **	**Flashes */on ****

[1] This mode of operation must always be set when using the Solicap rod and rope probes.

* The red LED flashes if there is a fault that you can correct.
** The red LED lights up continuously if the device has a fault that cannot be corrected. See also Page 61, "Troubleshooting".
*** Flashes at 5-second intervals.

6 Commissioning

6.1 Installation and function check

Make sure that the post-installation check and final check have been completed before you start your measuring point:

- For the "Post-installation" checklist, refer to Page 31.
- For the "Post-connection" checklist, refer to Page 41.

6.2 Commissioning with electronic inserts FEI52, FEI54, FEI55

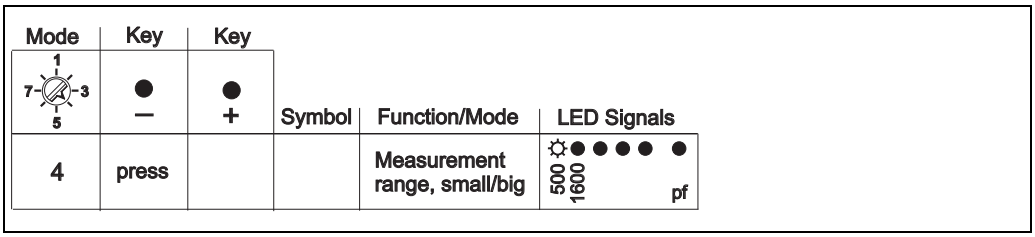
This chapter describes the commissioning of the Solicap M FTI55, FTI56 with the electronic inserts FEI52, FEI54, FEI55. These electronic inserts operate with the following firmware (FW):

- FW electronic insert FEI52: V 01.00.00
- FW electronic insert FEI54: V 01.00.00
- FW electronic insert FEI55: V 01.00.00

Note!
- When you start up the device for the first time, the output is in safe status.
  This is signaled by the flashing yellow LED 6.
- The device is not operational until you have carried out a calibration.
  To attain maximum operational safety, carry out an empty and a full calibration.
  This is particularly recommended for critical applications.

Refer to the following subchapters for information on how to carry out the calibration.

6.2.1 Setting the measuring range



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
4	Measuring range	Press		**On *** (500 pF)	**Off** (1600 pF)				

* These settings are factory settings.

Note!
- The choice of measuring range (0 to 500 pF and 0 to 1600 pF) depends on the function of the probe.
- If the probe is used as a limit switch, you can retain the factory setting of 0 to 500 pF.
- If the probe is used for two-point control, the following recommendations apply for vertical installation:
  – Measuring range from 0 to 500 pF for probe lengths up to 1 m
  – Measuring range from 0 to 1600 pF for probe lengths up to 22 m

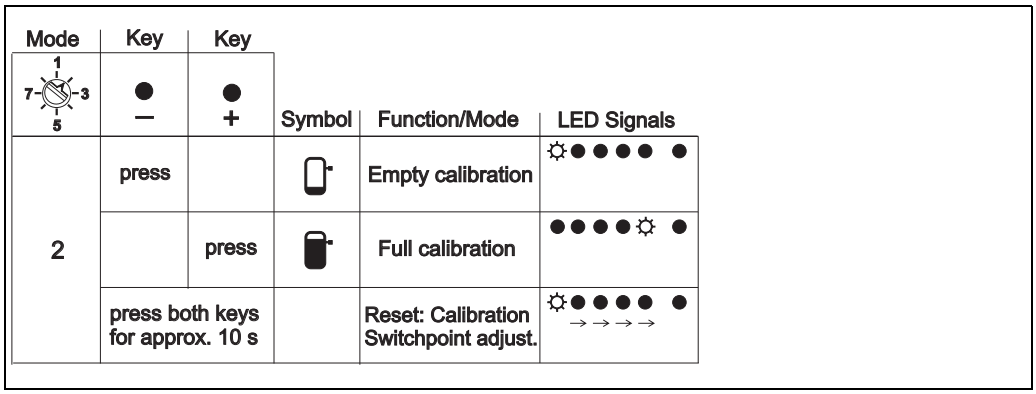
Suitable only for nonconductive bulk solids.

To set the range to 0 to 1600 pF, proceed as follows:

1. Turn the mode switch to position 4.
2. Press the "–" key for at least 2 seconds until the green LED 2 lights up.
3. Release the "–" key when the green LED 2 lights up.

The process for storing the measuring range changeover is now complete. Turn the mode switch to position 2 to continue the calibration.

6.2.2 Carrying out empty calibration



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
2	Empty calibration	Press		**On** (Calibration carried out)					**On/off/ flashes****
	Full calibration		Press					**On** (Calibration carried out)	**On/off/ flashes****
	Reset: Calibration and switchpoint adjustment	Press both keys for approx. 10 s		**On**	–>	–>	–>	–>	

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

Note!
- The empty calibration stores the capacitance value of the probe when the tank is empty. If the measured capacitance value is, for example, 50 pF (empty calibration), a switching threshold of 2 pF is added to this value. The capacitance value of the switchpoint would, in this case, be 52 pF.
- The switching threshold depends on the value set for the switchpoint adjustment (for more information, see Page 49).

To carry out an empty calibration, proceed as follows:

1. Check to make sure that the probe is not covered with product.
2. Turn the mode switch to position 2.
3. Press the "–" key for at least two seconds.
4. Release the "–" key when the green LED 1 starts to flash.

The process of saving the empty calibration is finished when the green LED 1 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

Reset calibration

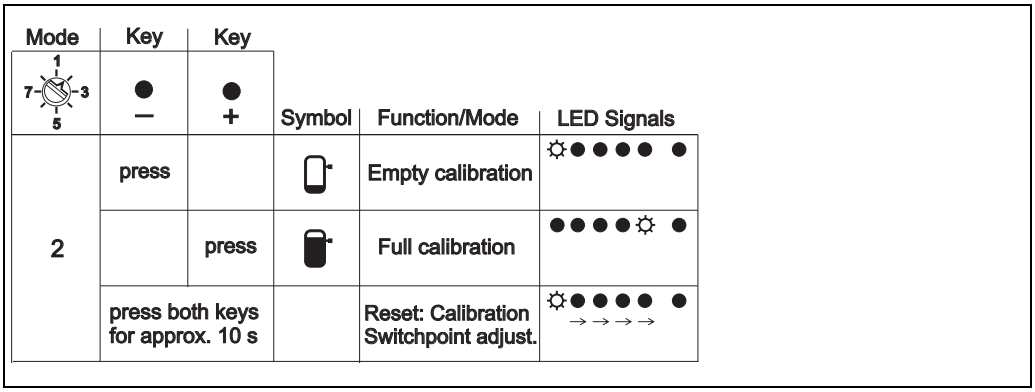
To reset the calibration / switchpoint adjustment, proceed as follows:

1. Turn the mode switch to position 2.
2. Press both the "–" and "+" keys for at least 10 seconds.
3. The green LEDs 1-5 light up in succession.

The reset calibration has been carried out and saved. The yellow LED 5 flashes.
The device is not operational until you have carried out a new calibration.

The switchpoint adjustment is reset to the factory setting of 2 pF.

6.2.3 Carrying out the full calibration



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
2	Empty calibration	Press		**On** (Calibration carried out)					**On/off/ flashes****
	Full calibration		Press					**On** (Calibration carried out)	**On/off/ flashes****
	Reset: Calibration and switchpoint adjustment	Press both keys for approx. 10 s		**On**	–>	–>	–>	–>	

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

Note!
- The full calibration measures the capacitance value of the probe when the tank is full. If the measured capacitance value is, for example, 100 pF (full calibration), a switching threshold of 2 pF is subtracted from this value. The capacitance value of the switchpoint is thus 98 pF.
- The switching threshold depends on the value set for the switchpoint adjustment (for more information, see Page 49).

To carry out a full calibration, proceed as follows:

1. Make sure that the probe is covered by the medium up to the desired switchpoint.
2. Turn the mode switch to position 2.
3. Press the "+" key for at least two seconds.
4. Release the "+" key when the green LED 5 starts to flash.

The process of saving the full calibration is complete when the green LED 5 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

6.2.4 Carrying out the empty and full calibration

Note!
- An empty and full calibration provides the greatest possible operational security. This is particularly recommended for critical applications.
- The empty and full calibration measures the capacitance values of the probes when the tank is full and when it is empty. If, for example, the measured capacitance value of the empty calibration is 50 pF and that of the full calibration is 100 pF, the average capacitance value, 75 pF, is stored as the switchpoint.

To carry out an **empty calibration**, proceed as follows:

1. Check to make sure that the probe is not covered with product.
2. Turn the mode switch to position 2.
3. Press the "–" key for at least two seconds.
4. Release the "–" key when the green LED 1 starts to flash.

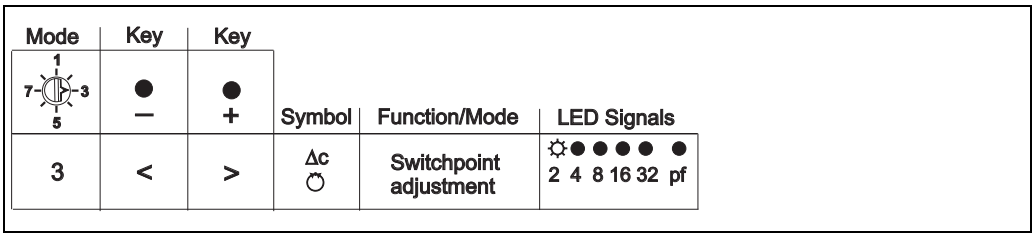
The process of saving the empty calibration is finished when the green LED 1 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

To carry out **a full calibration** proceed as follows:

1. Make sure that the probe is covered by the medium up to the desired switchpoint.
2. Turn the mode switch to position 2.
3. Press the "+" key for at least two seconds.
4. Release the "+" key when the green LED 5 starts to flash.

The process of saving the full calibration is complete when the green LED 5 lights up continuously. You can turn the mode switch back to position 1 to return to operation.

6.2.5 Setting the switchpoint adjustment



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
3	Switchpoint adjustment	Press for <	Press for >	**On *** (2 pF)	**Off** (4 pF)	**Off** (8 pF)	**Off** (16 pF)	**Off** (32 pF)	**On/off/ flashes****

* These settings are factory settings.

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.

Note!

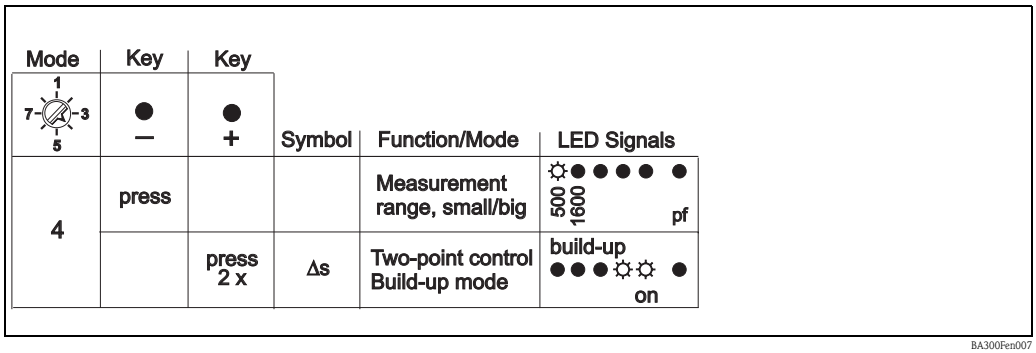
- If only one calibration (empty or full) was carried out, and if build-up forms on the probe rod while the probe is in operation, the device may no longer respond to changes in level. A switchpoint adjustment (e.g. 4, 8, 16, 32 pF) compensates for this condition and ensures that you obtain a constant switchpoint again.
- For media that do not have a tendency to build up, we recommend a setting of 2 pF, as the probe is most sensitive to changes in level at this setting.
- For media with heavy build-up (e.g. plaster), we recommend using probes with active build-up compensation.
- A switchpoint adjustment can be carried out only if a full **or** empty calibration has been carried out first.
- A switchpoint adjustment is not possible if an empty **and** a full calibration have been carried out.
- The switchpoint adjustment is disabled if you switch on the two-point control (as described on Page 50).

To adjust the switchpoint, proceed as follows:

1. Turn the mode switch to position 3.
   The green LED 1 lights up (factory setting).
2. Press the "+" key for at least two seconds to switch to the next higher value. If you press and hold down the "+" or "–" key, the value changes to the next one every two seconds. The active value is indicated by an LED (1 to 5).

After you have carried out the switchpoint adjustment, turn the mode switch to position 1 to return to operation.

6.2.6 Configuring two-point control and build-up mode



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
4	Measuring range	Press for <		**On *** (500 pF)	**Off** (1600 pF)				**On/off/ flashes****
	Two-point control Δs/ build-up mode		Press once Press twice				**Off** Build-up mode	**Off** Δs	**On/off/ flashes****

* These settings are factory settings.
** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

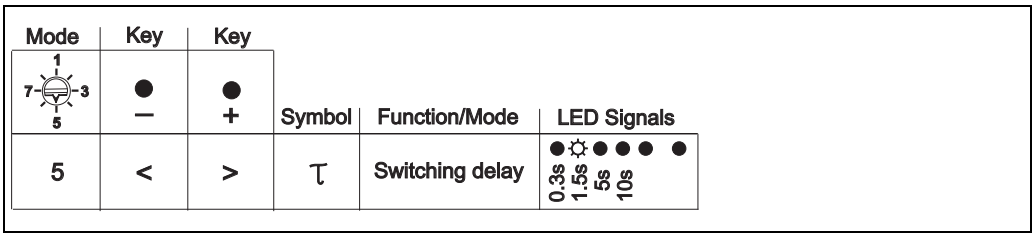
Note!
- You can also use the probe rod of a fully insulated and vertically installed probe for two-point control. The switchpoints of the empty **and** full calibration activate, for example, a handling device. If you want to use the two-point control, please note the following:
  – Carry out the empty calibration with the probe partially covered.
  – Set the measuring range from 0 to 1600 pF. For more information, see Page 45, "Setting the measuring range."
  – Set the fail-safe mode (MIN/MAX) according to your requirements. For more information, see Page 53.
- If you switch on the two-point control (Δs mode), the switchpoint adjustment (as described on Page 49) is disabled.
- "Build-up mode" causes a reliable switchpoint to be output even if the probe rod or probe rope is not completely cleared of the medium (e.g. plaster). Deposits or build-up on the probe rod/rope are compensated for.

To configure the two-point control and/or build-up mode, proceed as follows:

1. Turn the mode switch to position 4.
2. Press the "+" key for at least two seconds to switch on the **two-point control**. The green LED 5 lights up.
3. Press the "+" key again for at least two seconds to switch on **build-up mode**. Green LEDs 4 and 5 light up.
   – Pressing the "+" again for at least two seconds switches off both functions. Green LEDs 4 and 5 are off.
4. After you have configured the desired setting, turn the mode switch to position 1 to return to operation.

You have now completed the settings for the two-point control and build-up mode.

6.2.7 Setting the switching delay



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
5	Switching delay	Press for <	Press for >	**Off** (0.3 s)	**On *** (1.5 s)	**Off** (5 s)	**Off** (10 s)		**On/off/ flashes****

* These settings are factory settings.

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.

Note!

- The switching delay causes the device to signal the level limit after a delay.
  This is particularly useful in tanks with turbulent medium surfaces caused, for example, by the filling process or by collapsing mounds.
  By doing so, you ensure that the filling of the tank does not end until the probe is continuously covered by the medium.
- A switching delay that is too short may, for example, cause the filling process to be restarted as soon as the medium surface settles.

Caution!
If too long of a switching delay is set, this can cause the tank to overflow.

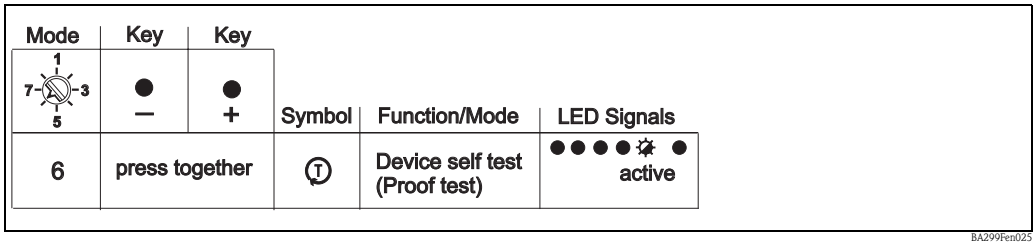
To set the switching delay, proceed as follows:

1. Turn the mode switch to position 5.
2. Press the "+" key for at least two seconds to select the next higher value. Hold the "+" or "–" keys down to skip from one value to another.
   The possible values are signalled by the LEDs 1 to 4.
3. Set the desired value.

You have now set the switching delay and can turn the mode switch back to position 1 (operation).

6.2.8 Activating the self-test (function test)

Caution!
Make sure that you do not accidentally activate any processes with the self-test!
This could result, for example, in overflowing of the tank.



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
6	Self-test (function test)	Press both keys		**on*** (inactive)				**Flashes** (active)	**On/off ** **

* These settings are factory settings.
** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

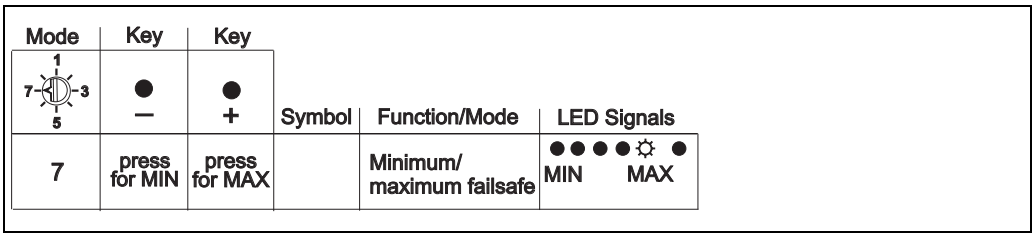
Note!
The self-test simulates switching states (probe not covered, probe covered).
This allows you to check if the connected devices are activated correctly.
The self-test lasts approx. 20 seconds and ends automatically.

To carry out a self-test, proceed as follows:

1. Turn the mode switch to position 6.
2. Press the "+" and "–" keys simultaneously for at least two seconds.
   The self-test is active when the green LED 5 flashes.
   The green operational LED 1 is off.
3. After approx. 20 seconds, the test is completed. This is indicated by the lighting up of the operational LED 1.

You have now carried out the self-test and can turn the mode switch back to position 1 (operation).

6.2.9 Setting the MIN/MAX fail-safe mode



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
7	MIN/MAX fail-safe mode	Press for MIN	Press for MAX	**Off** (MIN)				**On *** (MAX)	**On/off/ flashes****

* These settings are factory settings.

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set. The LED flashes if a calibration has not yet been carried out.

Note!
By selecting the fail-safe mode correctly, you ensure that the output always operates safely with quiescent current.

– **Minimum failsafe mode (MIN)**: The output switches if the switchpoint is undershot (probe rod/rope uncovered), a fault occurs or the line voltage fails.
– **Maximum failsafe mode (MAX)**: The output switches if the switchpoint is exceeded (probe rod/rope covered), a fault occurs or the line voltage fails.

To set the MIN or MAX fail-safe mode, proceed as follows:

1. Turn the mode switch to position 7.
2. Fail-safe mode
   – Press the "–" key for at least two seconds to set the MIN failsafe mode. The green LED 1 starts to light up.
   – Press the "+" key for at least two seconds to set the MAX failsafe mode. The green LED 5 starts to light up.

You have now set the fail-safe mode and can turn the mode switch back to position 1 (operation).

Output signal FEI52

Safety mode	Level	Output signal	LEDs green	LEDs red	LEDs yellow
MAX		L+ 1 → I_L → + 3	☀	●	☼
		1 - - - → I_R → 3	☀	●	●
MIN		L+ 1 → I_L → + 3	☀	●	☼
		1 - - - → I_R → 3	☀	●	●
Maintenance required *		1 - - - → I_L / I_R → 3	☀		
Instrument failure		1 - - - → I_R → 3		☼	●

TI418Fen43

** See Page 61, "Troubleshooting"*

Output signal FEI54

Safety mode	Level	Output signal	LEDs green	LEDs red	LEDs yellow
MAX		3 4 5 6 7 8	☀	●	☼
		3 4 5 6 7 8	☀	●	●
MIN		3 4 5 6 7 8	☀	●	☼
		3 4 5 6 7 8	☀	●	●
Maintenance required *			☀	☼	
Instrument failure		3 4 5 6 7 8	☀	☼	

TI418Fen48

** See Page 61, "Troubleshooting"*

Output signal FEI55

Safety mode	Level	Output signal	LEDs green	red	yellow
MAX		+ 2 ~16 mA 1	☼	●	☼
		+ 2 ~8 mA 1	☼	●	●
MIN		+ 2 ~16 mA 1	☼	●	☼
		+ 2 ~8 mA 1	☼	●	●
Maintenance required *		+ 2 8/16 mA 1	☼	☼	
Instrument failure		+ 2 < 3.6 mA 1	☼	☼	

TI418Fen51

** See Page 61, "Troubleshooting"*

Output signal FEI53

Mode	Output signal	LEDs green	red
Normal operation	3...12 V at terminal 3	☼	●
Maintenance required * 	3...12 V at terminal 3	☼	☼
Instrument failure 	< 2,7 V at terminal 3	☼	☼

TI418Fen46

** See Page 61, "Troubleshooting"*

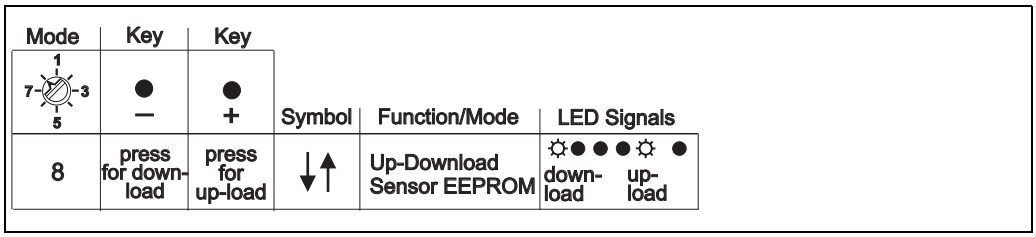
Output signal FEI57S

Mode	Output signal	LEDs green	red
Normal operation	60...185 Hz 1 - - - - - - 2	☼	●
Maintenance required * 	60...185 Hz 1 - - - - - - 2	☼	☼
Instrument failure 	< 20 Hz 1 - - - - - - 2	☼	☼

TI418Fen54

** See Page 61, "Troubleshooting"*

6.2.10 Sensor DAT (EEPROM) upload/download



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
8	Upload/download Sensor DAT (EEPROM)	Press for download	Press for upload	**Flashes** (download)				**Flashes** (upload)	**On/off/ flashes****

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

Note!

- The customer-specific settings of the electronic insert (e.g. empty/full calibration, switchpoint adjustment) are stored automatically in the Sensor DAT (EEPROM) and in the electronic insert.
- The Sensor DAT (EEPROM) is updated automatically each time a parameter is changed in the electronic insert.
- When replacing the electronic insert, all the Sensor DAT (EEPROM) data are transferred to the electronic insert by means of a manual upload. No additional settings are required.
- If, for example, you need to transfer the customer-specific settings of an electronic insert to multiple Sensor DATs (EEPROMs), you must carry out a manual download after installing the electronic insert.

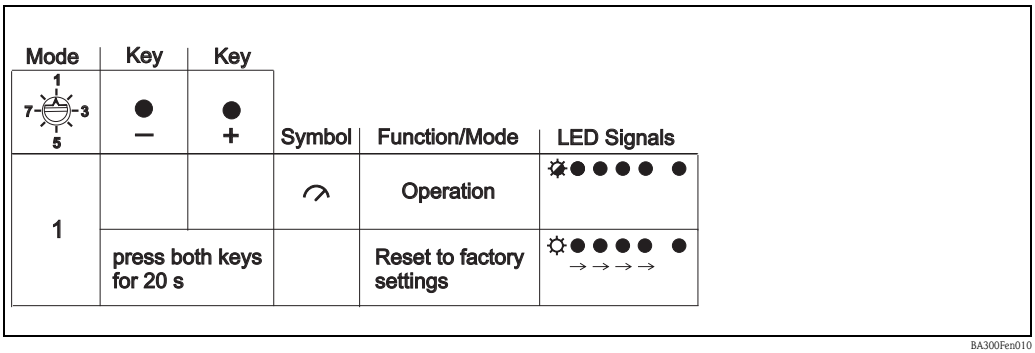
  – **Upload:** An upload transfers the saved data from the Sensor DAT (EEPROM) to the electronic insert. The electronic insert does not have to be configured any more, and the device is then operational.
  – **Download:** A download transfers the saved data from the electronic insert to the Sensor DAT (EEPROM).

To carry out a sensor upload/download, proceed as follows:

1. Turn the mode switch to position 8.
2. Press the "–" key for at least two seconds to carry out a download (the data from the electronic insert are transferred to the Sensor DAT (EEPROM).
   During the download, the green LED 1 flashes.
3. Press the "+" for at least two seconds to carry out an upload (the data from the Sensor DAT (EEPROM) are transferred to the electronic insert).
   The green LED 5 flashes during upload.

You have now transferred the data and can turn the mode switch back to position 1 (operation).

6.2.11 Restoring factory settings



Mode switch setting	Function	– key	+ key	Light emitting diodes (LED signals)					
				1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)
1	Operation			**Flashes** Operational LED		**Flashes** (warning/ alarm)			**On/off/ flashes****
	Restore factory setting	Press both keys for approx. 20 s		**On**	–>	–>	–>	–>	**Flashes****

** Switch status signaling depends on the mounting location selected and the fail-safe mode (MIN/MAX) set.
The LED flashes if a calibration has not yet been carried out.

Note!
- This function allows you to restore the factory settings. This is particularly useful if the device has already been calibrated once and, for example, there is a fundamental change in the medium in the tank.
- After restoring the factory settings, you must repeat the calibration.

To restore the factory settings, proceed as follows:

1. Turn the function switch to position 1.
2. Press the "+" and "–" keys simultaneously for at least 10 seconds. During the time it takes to restore the factory settings, the LEDs 1–5 light up consecutively.
3. The factory settings have been successfully restored if the green LED 1 and the yellow LED are flashing.

You have now restored the factory settings and can continue with setting the measuring range and the calibration.

6.3 Commissioning with electronic inserts FEI53 or FEI57S

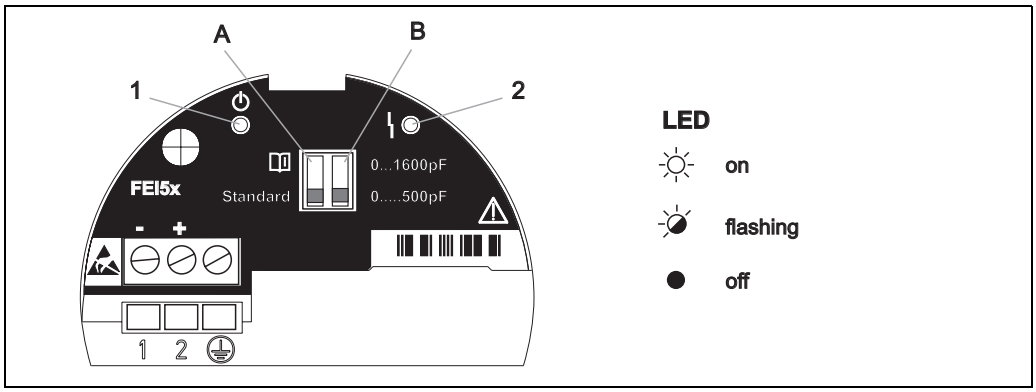
This chapter describes the commissioning of the Solicap M FTI55, FTI56 with the electronic inserts FEI53 and FEI57S. These electronic inserts operate with the following firmware (FW):

- FW electronic insert FEI53: V 01.00.00
- FW electronic insert FEI57S: V 01.00.00

Note!
The measuring system is not operational until
you have carried out a calibration at the switching unit.

For information on how to carry out the calibration, refer to the documentation for the Nivotester switching device FTCxxx.

6.3.1 Setting the alarm response if the measuring range is exceeded



BA300Fen016

DIP switches	Function	Light emitting diodes (LED signals)	
		1 (green) ⏻ Operational	2 (red) ↯ Fault
A	Standard[1]: If the measuring range is exceeded **no** alarm is output*.	**Flashes**	**Off**
	🕮: If the measuring range is exceeded **one** alarm is output.	**Flashes**	**Flashes**

[1] This mode of operation must always be set when using the Solicap rod and rope probes.

* These settings are factory settings.

Note!
- With this setting, you can determine the alarm response of the measuring system If the measuring range is exceeded. You can switch the alarm on or off if the measuring range is exceeded.
- All other settings with regard to the alarm response have to be configured on the respective Nivotester switching device.

6.3.2 Setting the measuring range

DIP switches	Function	Light emitting diodes (LED signals)	
		1 (green) ⏻ Operational	2 (red) ↯ Fault
B	Span: The measuring range is between 0 and 500 pF *.	**Flashes**	**Flashes **/on *****
	Span: The measuring range is between 0 and 1600 pF.	**Flashes**	**Flashes **/on *****

* These settings are factory settings.
** The red LED flashes if there is a fault that you can correct.
*** The red LED lights up continuously if the device has a fault that cannot be corrected. See also Page 61, "Troubleshooting".

Note!
- The choice of measuring range (0 to 500 pF and 0 to 1600 pF) depends on the function of the probe.
- If the probe is used as a limit switch, you can retain the factory setting of 0 to 500 pF.
- If the probe is used for two-point control, the following recommendations apply for vertical installation:
  – Measuring range from 0 to 500 pF for probe lengths up to 1.0 m
  – Measuring range from 0 to 1600 pF for probe lengths up to 4.0 m

All other settings must be made on the respective Nivotester switching device.

7 Maintenance

No special maintenance work is required for the Solicap M level measuring device.

Exterior cleaning

When cleaning the exterior of the Solicap M, make sure that the cleaning agent used does not corrode the housing surface or the seals.

Seals

The process seals of the pickup must be replaced periodically, particularly in the case of molded seals (aseptic version). The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the medium temperature.

Repair

In accordance with the Endress+Hauser repair principle, the devices have a modular design and repairs can be carried out by the customer.
Spare parts are grouped logically into kits along with the respective replacement instructions. In Chapter 9.2 (Page 62) you will find a list of all spare parts kits, together with their order numbers, that can be ordered from Endress+Hauser and used to repair the Solicap M. For more information about service and spare parts, contact Endress+Hauser Service.

Repairing Ex-certified devices

The following information also has to be taken into account for repairs of Ex-certified devices:
- Ex-certified devices may be repaired only by experienced, skilled staff or by Endress+Hauser Service.
- Applicable standards, federal/national Ex standards and the Safety Instructions (XA) and certificates must be observed.
- Only genuine spare parts from Endress+Hauser may be used.
- When ordering spare parts, please note the device designation on the nameplate. Parts can only be replaced by the same parts.
- Repairs must be carried out according to the instructions. Following the repair, the individual testing specified for the device must be carried out.
- Certified devices can only be converted into other certified devices by Endress+Hauser Service.
- Every conversion and repair made to the device must be documented.

Replacement

After replacing a Solicap M or the electronic insert, the calibration values must be transferred to the replacement device.

– If a probe is replaced, the calibration values are transferred to the Sensor DAT (EEPROM) by means of a manual download in the electronic insert.
– If the electronic insert is replaced, the calibration values are transferred to the electronics by means of a manual upload in the Sensor DAT (EEPROM).

This means that you can restart the device without having to carry out a new calibration (see also Page 56, Chapter 6.2.10).

8 Accessories

8.1 Weather protection cover

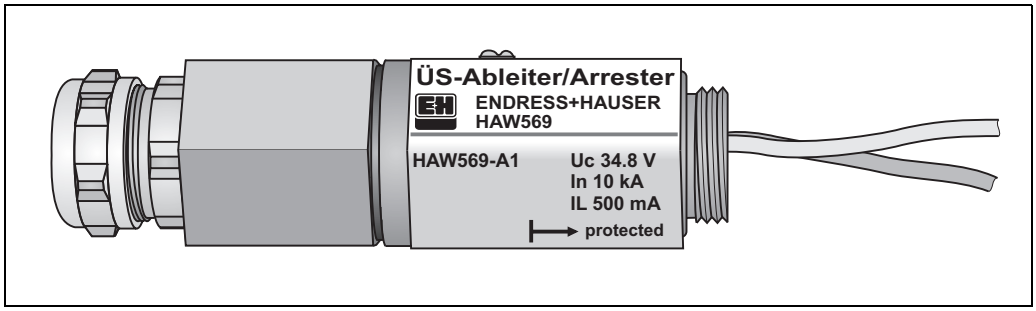
For F13 and F17 housing
TSP17090

8.2 Overvoltage protection HAW569

- HAW569–A11A (non-hazardous)
- HAW569–B11A (hazardous area)

Note!
These two versions can be screwed directly into the housing (M20x1.5).

Surge arrester for limiting overvoltage in signal lines and components. The HAW562Z module can be used in hazardous areas.



L00-FMI5xxxx-03-05-xx-xx-009

9 Troubleshooting

9.1 Fault diagnostics in the electronic insert

Note!
In the event of faults during commissioning or operation of the device, you have the ability to carry out fault diagnostics on the electronic insert. This function is supported by the electronic inserts FEI52, FEI54, FEI55 (see fault tables 1 and 2 below).

The electronic inserts FEI53 and FEI57S signal two types of faults:
- Correctable faults: The red LED flashes.
- Non-correctable faults: The red LED is lit continuously.

For additional information on fault detection and fault elimination, refer to fault table 2 below.

9.1.1 Activating fault diagnostics

Note!
The diagnostics provide information about the operating status of the device.
The results of the diagnostics are displayed by LEDs 1, 2, 4 and 5. If the diagnostics detect multiple faults, these are shown according to their priority. A serious fault (e.g. priority 3) is always displayed before a less serious fault (e.g. priority 5).

To activate the fault diagnostics, proceed as follows:
1. Set the function switch to position 1 (operation).
2. Press the "–" key for at least two seconds.
3. "Fault table 1" lists possible causes of faults and information on how to eliminate them.

LEDs for diagnostics						Fault table 1 (FEI52, FEI54, FEI55)		
1 (green)	2 (green)	3 (red)	4 (green)	5 (green)	6 (yellow)	Cause	Remedy	Priority
						No fault		
On						Internal fault	Replace electronics	1
	On					The calibration point is too close to the measuring range limit	Reduce the switchpoint or select a new mounting location	2
On	On					No calibration has yet been carried out	Carry out empty and/or full calibration.	3
			On			The DC PNP output is overloaded*	Reduce the connected load	4
On			On			The capacitance change from probe "covered" to probe "not covered" is too small	Contact Endress+Hauser Service	5
	On		On			Sensor DAT (EEPROM) data are invalid	Carry out download from the electronic insert	6
On	On		On			Probe is not detected**	The probe type is not compatible. Use a Solicap M probe	7
				On		The measured temperature is outside the permitted temperature range	Operate the device only in the specified temperature range	8

* Applies only to electronic insert FEI52.
** A connection to the Sensor DAT (EEPROM) could not be established.

Fault table 2 (all electronic inserts)	
Cause	Remedy
The device does not switch	Check the connection and the supply voltage
Alarm LED flashes	Reduce the ambient temperature e.g. by improving ventilation or replacing the device when removing the connection to the probe
Water in housing	Dry the housing and ensure that the cable gland is pulled tight and the housing cover is tightly sealed

9.2 Spare parts

Note!

- You can order spare parts directly from your E+H service organization by quoting the order number (see below).
- The corresponding spare part number is on every spare part. Installation instructions can be found in the form supplied with the spare parts.
- Before ordering, please note that all ordered spare parts must correspond with the indications on your nameplate. Otherwise, the device version will no longer match the information on the nameplate.

Electronic insert

- FEI52 electronic insert
  71025819
- FEI53 electronic insert
  71025820
- FEI54 electronic insert
  71025814
- FEI55 electronic insert
  71025815
- FEI57S electronic insert
  71025816

Cover for housing

- Cover for aluminum housing F13: gray with sealing ring
  52002698
- Cover for stainless steel housing F15: with sealing ring
  52027000
- Cover for stainless steel housing F15: with clasp and sealing ring
  52028268
- Cover for polyester housing F16, flat: gray with sealing ring
  52025606
- Cover for aluminum housing F17, flat: with sealing ring
  52002699
- Cover for aluminum housing T13 flat, electronics compartment: gray with sealing ring
  52006903
- Cover for aluminum housing T13 flat, connection compartment: gray with sealing ring
  52007103

Seal set for stainless steel housing

- Seal set for stainless steel housing F15: with 5 sealing rings
  52028179

9.3 Return

You must take the following measures before returning a measuring device to Endress+Hauser, for example for repair:
- Remove all traces of the medium. Pay particular attention to crevices and grooves for seals into which the medium can penetrate. This is particularly important if the medium is hazardous to health, e.g. combustible, toxic, caustic, carcinogenic etc.
- Always enclose a fully completed "Declaration of contamination" form with the device (a master copy of the "Declaration of contamination" form can be found at the end of these Operating Instructions). Only then can Endress+Hauser check or repair a returned device.
- If necessary, enclose special handling instructions when returning the device, e.g. a safety data sheet in accordance with EN 91/155/EEC.

In addition, specify the following:
- The chemical and physical properties of the medium
- A description of the application
- A description of the fault that occurred
- Operating time of the device

9.4 Disposal

At disposal, ensure that materials are properly separated and the device components are reused.

9.5 Firmware history

- FW electronic insert FEI52: V 01.00.00
- FW electronic insert FEI54: V 01.00.00
- FW electronic insert FEI55: V 01.00.00
- FW electronic insert FEI53: V 01.00.00
- FW electronic insert FEI57S: V 01.00.00

9.6 Contact addresses at Endress+Hauser

On the back page of these Operating Instructions, you can find an internet address for Endress+Hauser. The web site provides contact addresses that you can use in case of any questions.

10 Technical data

10.1 Input

10.1.1 Measured variable

Level limit detection of the change in capacitance between the probe rod and the tank wall, depending on the level of the bulk solids.

10.1.2 Measuring range (valid for all FEI5x)

- Measuring frequency:
  500 kHz
- Span:
  ΔC = 0 to 1600 pF
- Final capacitance:
  C_E = max. 1600 pF
- Adjustable initial capacitance:
  C_A = 0 to 500 pF (range 1 = factory setting)
  C_A = 0 to 1600 pF (range 2)

10.1.3 Input signal

Probe covered => high capacitance
Probe not covered => low capacitance

10.2 Output

10.2.1 Galvanic isolation

FEI52
between rod probe and power supply

FEI54
between rod probe, power supply and load

FEI53, FEI55, FEI57S
see connected switching device (functional galvanic isolation in the electronic insert)

10.2.2 Switch behavior

Binary or Δs mode (controlling a screw conveyor)

10.2.3 Switch-on behavior

When the power supply is switched on, the switching status of the outputs corresponds to the signal on alarm. The correct switch condition is reached after max. 3 seconds.

10.2.4 Fail-safe mode

Minimum/maximum quiescent current safety can be switched at the electronic insert (for FEI53 and FEI57S only at Nivotester FTCxxx)

MIN = minimum safety: The output switches safety-oriented when the probe is uncovered (signal on alarm). Used for dry-running protection and screw conveyor, for example

MAX = maximum safety: The output switches safety-oriented when the probe is covered (signal on alarm). For use with overfill protection for example

10.2.5 Switching delay

FEI52, FEI54, FEI55
Can be adjusted incrementally in the electronic insert: 0.3 to 10 s

FEI53, FEI57S
Depends on the connected Nivotester transmitter

10.3 Performance characteristics

10.3.1 Reference operating conditions

- Temperature: +20 °C ±5 °C
- Pressure: 1013 mbars abs. ±20 mbars
- Humidity: 65 % ±20%

10.3.2 Switchpoint

Reproducibility: 0.1 % (related to the probe length)

10.3.3 Ambient temperature effect

Electronic insert

< 0.06 % / 10 K related to the full scale value

Separate housing

Capacitance change in connecting cable 0.015 pF/mK

10.4 Operating conditions: Environment

10.4.1 Ambient temperature range

- Ambient temperature of the transmitter: –50 C to +70 C (note derating; see Page 67 ff.)
- A weather protection cover should be used when operating outdoors in strong sunlight. For further information on the weather protection cover, see Page 60.

10.4.2 Storage temperature

–50 to +85 °C

10.4.3 Climate class

DIN EN 60068-2-38/IEC 68-2-38: test Z/AD

10.4.4 Degree of protection

In accordance with EN60529

	IP66	IP67	IP68	NEMA4X
Polyester housing F16	X	X	–	X
Stainless steel housing F15	X	X	–	X
Aluminum housing F17	X	X	–	X
Aluminium housing F13 with gas-tight process seal	X	–	X	X
Aluminum housing T13 with gas-tight process seal and separate connection compartment (EEx d)	X	–	X	X
Separate housing	X	–	X	X

10.4.5 Vibration resistance

DIN EN 60068-2-64/IEC 68-2-64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$

10.4.6 Cleaning

Housing:
When cleaning, make sure that the cleaning agent used does not corrode the housing surface or the seals.

Probe:
Depending on the application, build-up (contamination and soiling) can form on the probe rod. A high degree of material build-up can affect the measurement result. If the medium tends to create a high degree of build-up, regular cleaning is recommended. When cleaning, it is important to make sure that the insulation of the probe rod is not damaged. If cleaning agents are used make sure the material is resistant to them!

10.4.7 Electromagnetic compatibility (EMC)

- Interference emission to EN 61326, Electrical Equipment Class B
  Interference immunity in accordance with EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC)
- A usual commercial instrument cable can be used.

10.4.8 Shock resistance

DIN EN 60068-2-27/IEC 68-2-27: 30g acceleration

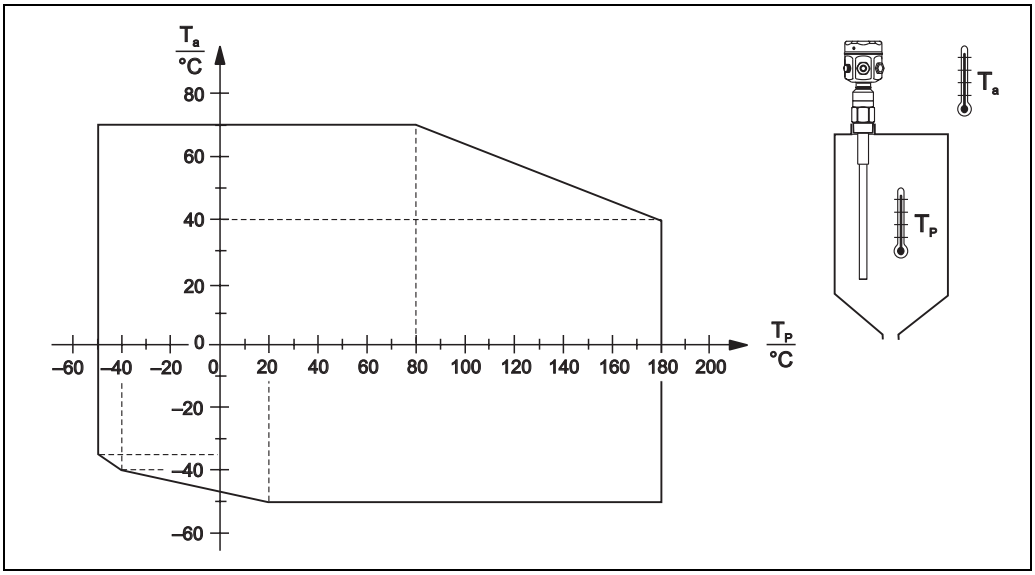
10.5 Operating conditions: Process

10.5.1 Process temperature range

Permitted ambient temperature T_a at the housing depending on the process temperature T_p in the tank.

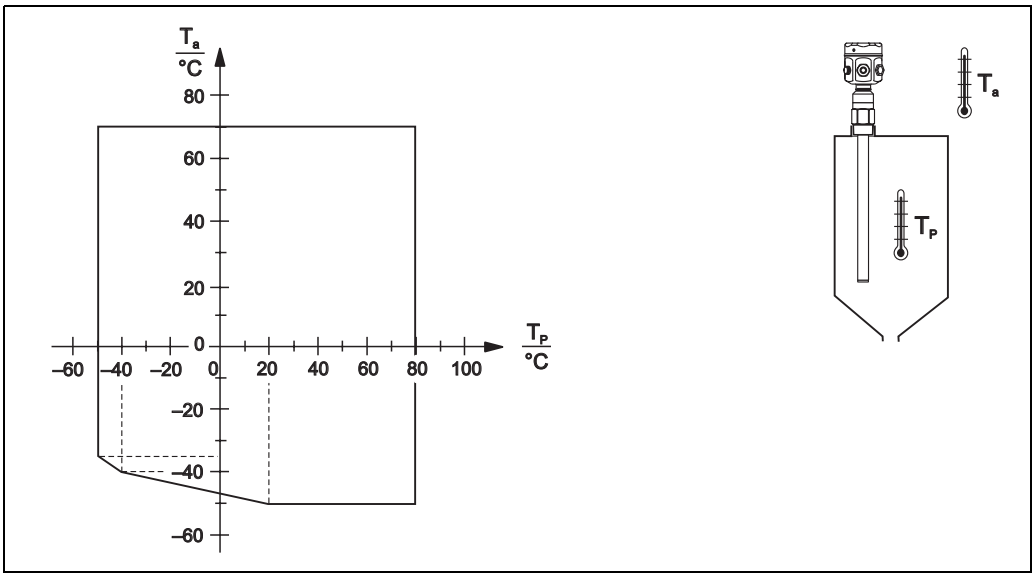
Rod probe FTI55

Partially insulated (PPS):



TI418F60

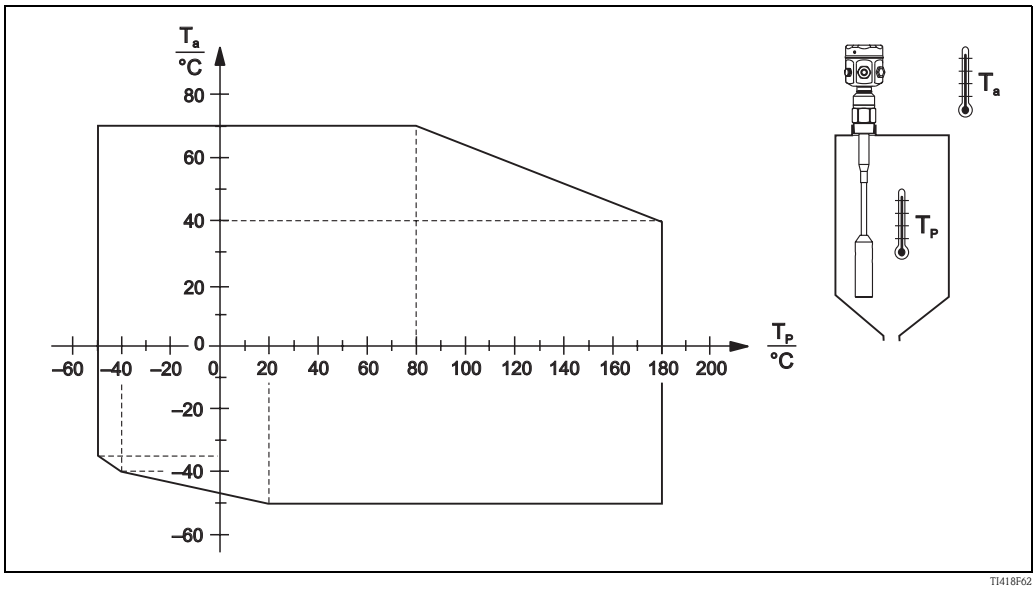
Fully insulated (PE):



TI418F61

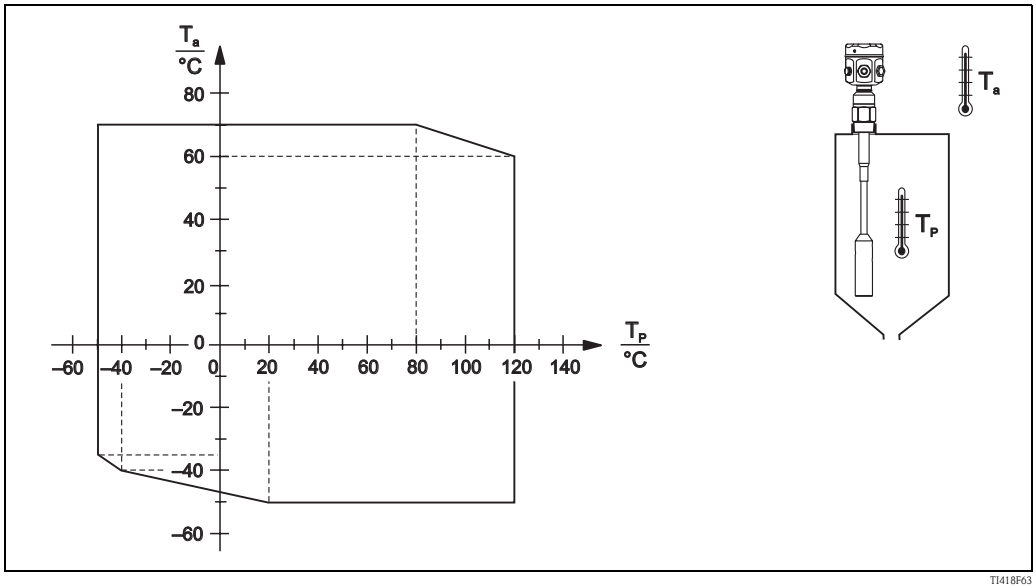
Rope probe FTI56

Partially insulated (PTFE):



TI418F62

Fully insulated (PA):

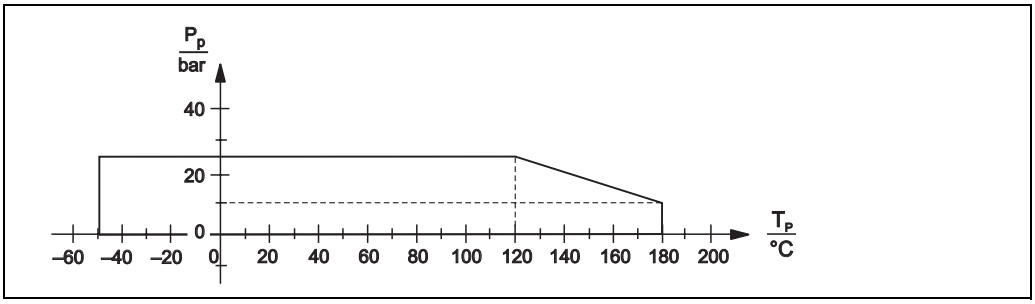


TI418F63

10.5.2 Process pressure and temperature derating

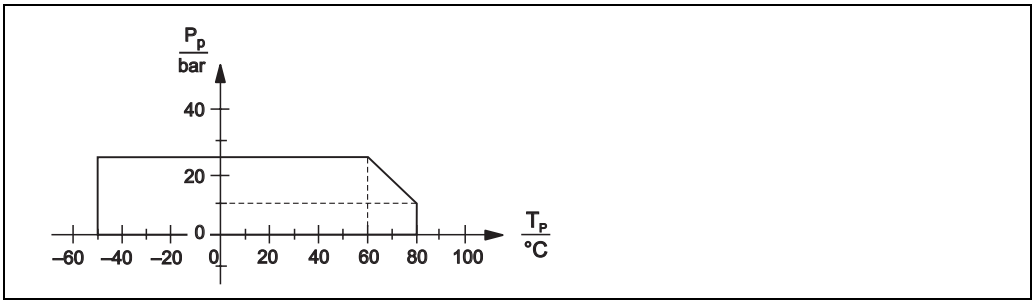
Rod probe FTI55

Partially insulated (PPS):



TI418F64

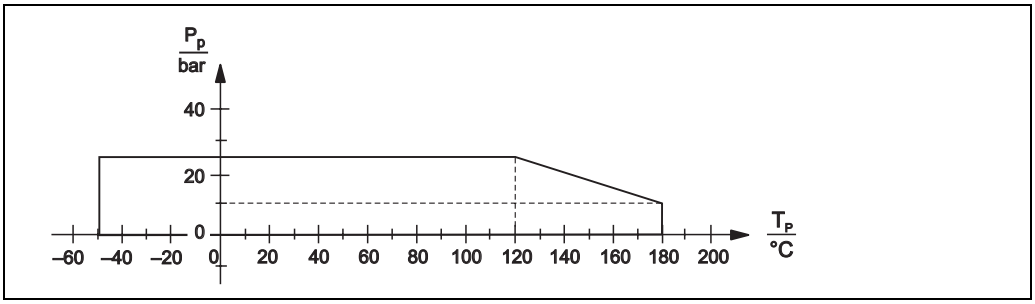
Fully insulated (PE):



TI418F65

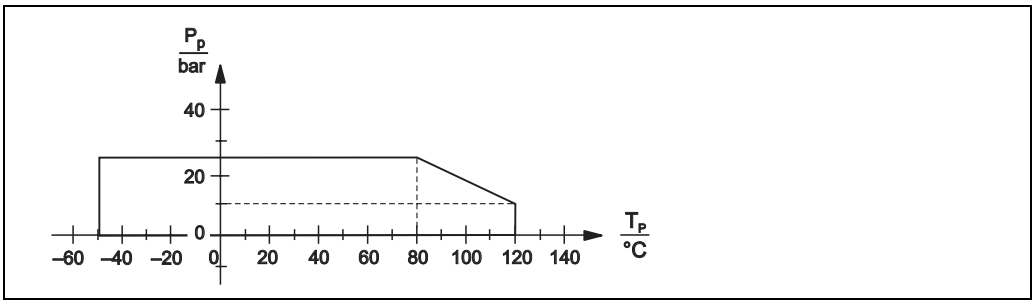
Rope probe FTI56

Partially insulated (PTFE):



TI418F64

Fully insulated (PA):



TI418F66

10.5.3 Application examples

Sand, glass aggregate, gravel, moulding sand, lime, ore (crushed), plaster, aluminium shavings, cement, grain, pumice, flour, dolomite, sugar beet, kaolin, fodder and similar bulk solids.

In general:
Bulk solids with a relative dielectric constant $\varepsilon_r \geq 2.5$.

10.6 Other standards and guidelines

EN 60529
Degrees of protection by housing (IP code)

EN 61010
Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures

EN 61326
Interference emission (Class B equipment), interference immunity (Appendix A – Industrial).

NAMUR
Association for Standards for Control and Regulation in the Chemical Industry

10.7 Documentation

Note!
This documentation is available on the product pages at www.endress.com

10.7.1 Technical Information

- Solicap M FTI55, FTI56
  TI418F/00/en

10.7.2 Certificates (under development)

Safety information (ATEX)

- Solicap M FTI55, FTI56
  ATEX II 1 D Ex tD A20 IP65 T 90 °C,
  ATEX II 1/2 D Ex tD A20/A21 IP65 T 100 °C
  XA389F/00/a3

Control drawings

- Solicap M FTI55, FTI56
  FM
  ZDxxxF/00/en
- Solicap M FTI55, FTI56
  CSA
  ZDxxxF/00/en

10.7.3 Patents

This product is protected by at least one of the patents listed below.
Further patents are under development.

- DE 203 00 901 U1
- DE 103 22 279,
  WO 2004 102 133,
  US 2005 003 9528
- DE 203 13 695,
  WO 2005 025 015

Index

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